SUSTAINABLE INNOVATIVE SOLUTIONS FOR INDUSTRY, ENERGY AND SMART CITIES

Editors

Tanuja Kaushik

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Co- Editors

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Aarzoo



Sustainable Innovative Solutions for Industry, Energy, and Smart Cities

First Volume

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Title of the Book: Sustainable Innovative Solutions for Industry, Energy, and Smart Cities

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Preface

In a world increasingly interconnected and complex, the traditional compartmentalization of knowledge feels less and less relevant. The challenges we face – from climate change to artificial intelligence – transcend the boundaries of single disciplines. This book is a testament to this truth, a vibrant tapestry woven from the threads of diverse fields, each chapter a testament to the power of interdisciplinary thinking.

This book is an invitation to break down the walls of knowledge, to see the rich connections that exist between seemingly disparate fields. It brings together a fascinating array of topics, each a testament to the richness and breadth of human knowledge. From the intersection of technological innovation and agricultural branding to the ancient Indian understanding of astronomy, the chapters within these pages demonstrate the power of exploring seemingly disparate subjects through a unified lens.

Environmental concerns are addressed through studies on nature-based solutions for sustainability and the impact of microplastics on water. Public health is addressed in chapters examining pharmaceutical drug consumption and diabetes awareness among university students.

Social issues are also highlighted in chapters which explore the role of NGOs in women's empowerment, the impact of the *Beti Bachao Beti Padhao* initiative, and corporate social responsibility practices. Government programs are also analysed as in the chapter that looks at the Pradhan Mantri Bharatiya Janaushadhi Pariyojana.

Even creativity finds its own niche in this book, with a chapter examining the art of innovation through design thinking and a delightful exploration of the confluence of Bharatiya dance and fashion.

We hope this book serves as a bridge, fostering collaboration and sparking intellectual curiosity, serving as an invaluable resource for students, researchers, and anyone with a thirst for knowledge.

Acknowledgement

We extend our heartfelt gratitude to all those who contributed to the creation of this edited book. This endeavour would not have been possible without the collective efforts and unwavering support of many individuals.

First and foremost, we express our deepest appreciation to Ms. Arpita Rastogi, Dr. Sapna Sharma, Dr. Jyoti Gullaiya, Ms. Pooja Chopra, Dr. Urvashi Kumari, Ms. Heena Parveen, Mr. Abhishek Jha, Ms. Pooja Mathur, Ms. Ashi Bhatnagar, Mr. Manish Joshi, and Mr. Sandeep Kumar Yadav, faculty of GD Goenka University, who have been the cornerstone of this project.

We are profoundly grateful to our contributors, whose chapters have enriched this book with diverse perspectives and innovative ideas. Your commitment to advancing interdisciplinary education is truly inspiring.

Special thanks to the administration for their continuous support and encouragement. Your belief in the importance of interdisciplinary education has been instrumental in bringing this project to fruition.

We also acknowledge the invaluable assistance of our editorial team, whose meticulous attention to detail and tireless efforts have ensured the highest quality of this publication.

Your professionalism and dedication are deeply appreciated.

Finally, we extend our gratitude to the readers of this book. We hope that the insights and knowledge shared within these pages will inspire and contribute to the ongoing dialogue on interdisciplinary education.

Thank you all for making this projects a reality.

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Branding of Agri-Products: Enhancing Market Presence and Consumer Trust

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Abstract

Branding has emerged as a pivotal strategy in the agricultural sector, transforming how agricultural products are perceived and consumed. This paper explores the significance of branding in agriculture, its impact on market dynamics, and the benefits it offers to both producers and consumers. Branding helps differentiate products in a crowded market, fostering consumer trust and loyalty by guaranteeing consistent quality and ethical standards. Key branding strategies include the use of geographical indications (GIs), organic and fair-trade certifications, storytelling and provenance, innovative packaging, and digital marketing.

The paper reviews successful case studies such as the Appellation d'Origine Contrôlée (AOC) for French wines, Organic Valley's emphasis on sustainable farming, and Karnataka's Coorg Coffee, highlighting their unique branding approaches. Despite the numerous benefits, challenges such as standardization, certification costs, market penetration, and consumer awareness are addressed. The paper concludes that effective branding is not merely a marketing tool but a strategic approach to creating value, trust, and differentiation in the marketplace. As consumer preferences evolve towards quality, sustainability, and ethical practices, branding of agri-products can significantly enhance market presence and foster consumer loyalty. By adopting robust branding strategies, agricultural producers can navigate market challenges and capitalize on emerging opportunities, ultimately leading to better market positioning, higher prices, and increased consumer satisfaction. This comprehensive analysis underscores the transformative potential of branding in the agricultural sector.

Keywords: Agri-Products, Branding, Market Presence & Consumer Trust

Introduction

Due to economic growth, the creation and promotion of strong brands for Indian agribusiness and for industry is an important aspect for the strategies of Indian agribusiness companies, farmers and entrepreneurs and exporters for entering as well as create a competitive advantage in the domestic and global

market. As consumers income rise, demand becomes more discriminating, i.e. a wider variety and a higher quality are sought, particularly by expanding groups of higher income groups in urban areas. Thus, brands of commodities play a vital role whether the product is manufactured from industry or from agriculture. This can be done by value addition of that product. An understanding of the psychological aspects, we explore how a non-traditional approach — based on marketing and supply-chain principles commonly used by large multinational companies to develop profitable agricultural brands in mature markets.

Thus, for a sustainable growth of market in India it is essential to maintain good quality of the commodity in the country. This creates a need to evaluate branding of commodities market; their impact on urban planning.

In recent years, technological advancements have permeated every aspect of our lives, including agriculture and branding. This interdisciplinary project explores the intersection of technology and branding within the agricultural sector, focusing on how innovative technologies can revolutionize the branding of agricultural products. By integrating principles from agricultural science, marketing, digital media, and design, this project aims to propose novel strategies for enhancing the branding of agricultural products through technological innovation.

By conducting a comprehensive review of existing literature on agricultural branding, technological innovations in agriculture, and emerging trends in digital marketing covered following components:

1. **Technological Innovations in Agriculture:** Explore cutting-edge technologies such as precision agriculture, IoT (Internet of Things), blockchain, AI (Artificial Intelligence), and drones, and their applications in agricultural production and supply chain management.

2. **Digital Marketing and Branding Strategies:** Explore the role of social media, e-commerce platforms, and digital advertising in promoting agricultural brands to consumers.

3. **Design and Visualization:** Collaborate with graphic designers and digital artists to create mock-ups and visual representations of technologically innovative branding concepts for agricultural products.

4. **Implementation Plan:** Propose strategies for collaborating with stakeholders across the agricultural value chain, including farmers, producers, distributors, retailers, and consumers.

5. **Ethical and Sustainability Considerations:** Address ethical concerns related to the use of technology in agriculture, such as data privacy, environmental impact, and socioeconomic implications.

6. **Educational Outreach and Public Engagement:** Organize workshops, seminars, and online forums to facilitate knowledge exchange and collaboration between stakeholders in the agriculture and branding sectors.

Problem Statement

Despite the vital role of agriculture in sustaining economies and livelihoods globally, the sector faces numerous challenges related to branding and marketing of agricultural products. Traditional branding methods often struggle to communicate the value proposition of agricultural products effectively, leading to issues such as commoditization, price volatility, and limited market access for farmers and producers. Moreover, consumers are increasingly demanding transparency, authenticity, and sustainability in their food choices, posing additional pressures on agricultural brands to adapt and innovate.

The agricultural sector is confronted with the challenge of effectively communicating the value, quality, and sustainability of its products to consumers in a rapidly evolving marketplace. Traditional branding methods are often inadequate in meeting the expectations of modern consumers, who seek transparency, authenticity, and traceability in their food purchases. Additionally, farmers and producers face difficulties in differentiating their products, maintaining market competitiveness, and capturing fair value for their efforts.

Furthermore, there is a lack of comprehensive understanding regarding the potential of technological innovations to address these challenges and transform the branding of agricultural products. While advancements such as blockchain, IoT, AI, AR, and data analytics hold promise in enhancing transparency, improving supply chain efficiency, and enhancing consumer engagement, their adoption and integration into agricultural branding strategies remain limited and fragmented.

How can technological innovations are leveraged to overcome the challenges faced by the agricultural sector in branding its products effectively, enhancing transparency, consumer trust, and market competitiveness while promoting sustainability and equitable value distribution along the supply chain.

Research Gap

- Value seeking Indian consumer
- Indian retailers
- Scalability challenges
- Market structure
- Poor farmer awareness
- Quality

Result and Discussion

Importance of Branding in Agri-Products

Market Differentiation: Branding helps distinguish products in a crowded market, allowing consumers to identify and choose products based on perceived quality and values. Unlike generic commodities, branded agri-products can leverage unique selling points such as superior taste, health benefits, or sustainable production methods.

Consumer Trust: A strong brand can build trust by guaranteeing consistent quality and adherence to ethical standards. Consumers are more likely to purchase products from brands they recognize and trust, particularly when it comes to food safety and ethical concerns.

Price Premium: Branded products often command higher prices, providing better margins for producers. Consumers are willing to pay more for products they perceive as higher quality or ethically produced, which can significantly boost the profitability of agricultural enterprises.

Loyalty and Repeat Purchases: Effective branding fosters consumer loyalty, leading to repeat purchases and long-term market stability. A loyal customer base provides a steady revenue stream and reduces the need for constant marketing expenditure.

Branding Strategies for Agri-Products

Geographical Indications (GIs): Products linked to specific regions (e.g., Champagne, Darjeeling tea) leverage regional reputation and unique characteristics. Geographical indications can protect the name of a product from a particular region, ensuring that only products genuinely originating from that region can be marketed as such.

Organic and Fair Trade Certifications: Labels such as USDA Organic or Fair Trade certify adherence to specific standards, appealing to ethically-conscious consumers. These certifications indicate that the products have been produced in an environmentally sustainable and socially responsible manner.

Storytelling and Provenance: Narratives about the farm, production methods, and farmer stories enhance the emotional connection with consumers. Consumers are increasingly interested in the origin of their food, and storytelling can make products more relatable and appealing.

Packaging and Design: Innovative packaging that highlights brand values and product benefits attracts consumer attention. Good packaging can also enhance the perceived quality of the product and differentiate it from competitors.

Digital Marketing: Utilizing social media and e-commerce platforms to reach broader audiences and engage directly with consumers. Digital marketing allows for targeted advertising and direct interaction with consumers, fostering a deeper brand connection.

Case Studies

Appellation d'Origine Contrôlée (AOC) – French Wines: AOC labels guarantee the origin and quality of wines, helping consumers trust the product's authenticity and heritage. This system ensures that only wines produced in designated areas using traditional methods can carry the AOC label, thus protecting the reputation of French wines.

Organic Valley: A cooperative of organic farmers in the USA that emphasizes sustainable farming and organic certifications to build a loyal consumer base. Organic Valley's branding focuses on its commitment to organic farming and high-quality, ethically-produced dairy products.

Karnataka’s Coorg Coffee: Leveraging the unique climate and cultivation methods of Coorg, this coffee brand has carved a niche in the premium coffee market. Coorg Coffee's branding highlights its geographic origin and distinctive flavor profile, appealing to coffee connoisseurs.

Challenges in Branding Agri-Products

Standardization and Quality Control: Ensuring consistent quality across all products under a brand can be challenging, particularly with natural variability in agriculture. Variations in weather, soil conditions, and farming practices can affect product quality, making standardization difficult.

Cost of Certification: Obtaining and maintaining certifications like organic or fair trade can be expensive and time-consuming for small farmers. The costs associated with certification can be a significant barrier, particularly for small-scale producers.

Market Penetration: Breaking into established markets dominated by large brands requires significant investment in marketing and distribution. New entrants need to invest heavily in building brand awareness and establishing distribution networks.

Consumer Awareness: Educating consumers about the benefits and values of branded Agri-products can be challenging. Consumers may be skeptical of new brands or unaware of the benefits of certified and branded products.

Benefits of Branding to Producers and Consumers

Producers: Branding can lead to better market positioning, higher prices, and increased bargaining power with retailers. Producers can also build a loyal customer base, reducing reliance on fluctuating commodity markets.

Consumers: Branded Agri-products offer assurance of quality, safety, and ethical production practices, meeting the growing demand for transparency. Consumers benefit from knowing the origin and production methods of their food, which can influence their purchasing decisions.

Conclusion

Branding in the agricultural sector represents a fundamental shift from traditional commodity-based markets to value-added, differentiated products. This transformation is driven by the evolving preferences of consumers who are increasingly concerned with quality, sustainability, and ethical production practices. By creating strong, recognizable brands, agricultural producers can enhance their market presence, build consumer trust, and achieve better economic outcomes.

Enhancing Market Presence: Effective branding differentiates agri-products in a crowded and competitive market. Products that are branded can stand out by highlighting unique attributes such as geographic origin, organic production methods, or adherence to fair trade principles. For example, geographical indications (GIs) like Champagne or Darjeeling tea leverage the unique characteristics and reputation of their regions to command premium prices and consumer loyalty. Similarly, organic and fair trade certifications communicate a commitment to environmental and social standards, appealing to ethically conscious consumers.

Building Consumer Trust: A strong brand acts as a guarantee of quality and consistency. Consumers are more likely to trust and repeatedly purchase products from brands they recognize and have had positive experiences with. This trust is especially important in the agricultural sector, where food safety and quality are paramount. Brands that emphasize transparency, such as by sharing detailed information about production methods and farmer stories, can deepen the emotional connection with consumers and reinforce their trust.

Economic Benefits for Producers: Branding allows producers to command higher prices and improve their margins. Branded products often achieve a price premium because consumers are willing to pay more for products they perceive as higher quality or ethically produced. This premium can be significant in markets where consumers are willing to invest in their values, such as organic or fair trade markets. Additionally, strong brands can provide producers with greater bargaining power in negotiations with retailers and distributors, further enhancing their economic position.

Overcoming Challenges: While the benefits of branding are substantial, several challenges must be addressed. Standardization and quality control are critical to maintaining the integrity of a brand. Variability in agricultural production due to factors like weather and soil conditions can make it difficult to ensure consistent quality. Producers must implement rigorous quality control measures to uphold their brand's reputation.

The cost of certification for organic or fair trade labels can be prohibitive for small farmers. These certifications require significant investment in both time and money. However, cooperative models like Organic Valley show that collective efforts can help small producers achieve certification and market their products under a unified brand.

Market penetration remains another significant challenge. New brands face difficulties in breaking into established markets dominated by large, well-known brands. Substantial investment in marketing and distribution is required to build brand awareness and establish a market presence. Digital marketing and e-commerce platforms offer new opportunities for reaching broader audiences and engaging directly with consumers, but they also require a strategic approach and ongoing effort.

Future Prospects: As consumer preferences continue to evolve towards quality, sustainability, and ethical considerations, the importance of branding in the agricultural sector will only grow. Producers who invest in building strong brands will be well-positioned to capitalize on these trends. The future of agricultural branding lies in leveraging technology, storytelling, and innovative

marketing strategies to create compelling brand identities that resonate with consumers.

Final Thoughts: Branding in agriculture is not just a marketing tool; it is a strategic approach that adds value, fosters consumer loyalty, and enhances market presence. By differentiating products and building trust, branding allows agricultural producers to navigate market challenges and seize emerging opportunities. As the marketplace becomes increasingly competitive and consumer-driven, effective branding will be essential for the success and sustainability of agricultural enterprises.

In conclusion, the branding of agri-products is a powerful strategy that transforms commodities into valued, differentiated products. It benefits producers by allowing them to command higher prices and build loyal customer bases while providing consumers with the assurance of quality and ethical production practices. Through robust branding strategies, the agricultural sector can achieve sustainable growth and meet the evolving demands of the market.

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Nature-Based Solutions: A Pathway to a Net-Zero Future

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Abstract

The world faces an unprecedented climate crisis, with greenhouse gas (GHG) emissions rapidly accelerating the planet's warming trajectory. Achieving net-zero emissions is necessary to mitigate catastrophic consequences of climate change. Nature-based solutions (NBS) involves protecting, restoring, or managing ecosystems to address environmental issues like climate change, water security, and even disaster prevention. While technological advancements are essential, NBS are becoming more and more regarded as essential allies on this journey. In order to achieve a net-zero future, this review paper explores the various kinds of NBS as well as opportunities and potential problems that come with implementing them into practice. By adopting NBS, we can build a safer and environmentally friendly future for all, where humanity and nature thrive in harmony.

Keywords: Nature-based solutions, greenhouse gas emission, net-zero future, carbon sequestration, blue carbon ecosystem, urban greening

Introduction

In order to prevent disastrous climate effects, the Intergovernmental Panel on Climate Change (IPCC) underlines how urgent it is to keep global warming to 1.5°C (IPCC, 2021). To avert the catastrophic consequences of unchecked climate change, a global transition to net-zero emissions is imperative. Net-zero implies achieving an equilibrium between emissions and removals of GHG, effectively eliminating human-caused contributions to atmospheric warming either through direct capture and disposal or anthropogenically enhanced natural removal processes (IPCC, 2023). The term net-zero may be applied to an individual gas, such as CO_2, or a basket of gases combined using a GHG metric (Allen et al., 2022). We run the risk of going above the 1.5°C warming threshold set forth in the 2015 Paris Climate Agreement, which would do irreversible harm to our planet and its inhabitants. Thus, decarbonisation of economy must be done at faster pace to achieve net-zero targets by 2055 (Girardin et al., 2021). Soterroni et al. (2023) found that Brazil could reach net-zero GHG emissions by around 2040 if it fully enforces its forest code, ends legal deforestation, and embarks on extensive ecosystem

restoration efforts. On the other hand, achieving net-zero in United Kingdom is mainly dependent on extensive implementation of NBS, such as restoring peatlands, creating saltmarshes, and establishing woodlands, in addition to substantial and continuous decreases in fossil fuels utilisation (Bradfer-Lawrence et al., 2021).

NBS refer to actions that protect, sustainably manage, and restore natural or modified ecosystems. These actions promote human well-being and biodiversity while addressing social problems in an efficient and adaptable manner (Seddon et al., 2021; Griscom et al., 2017; Cohen-Shacham et al., 2016). NBS also offer a potential path towards a net-zero future. The urgency to address climate change demands immediate and multifaceted action. While technological innovations like renewable energy and carbon capture are essential, they cannot address the challenge alone. NBS provide an alternative strategy to utilise nature's force to combat climate change. In November, 2021, India has also pledged to achieve net-zero emissions by 2070 at the COP26, Glasgow, United Kingdom. This ambitious goal demonstrates India's resolve to address climate change and make the transition to a greener and cleaner future (Yadav et al., 2023). About 25% of the world's total GHG emissions are attributable to land use. The IPCC (2023) highlighted the efficacy of NBS in reducing GHG emissions within the land-use sector. According to Girardin et al. (2021), the implementation of NBS could result in reductions of 0.1°C, 0.3°C, and 0.3°C in peak warming under scenarios of global warming reaching 1.5°C by 2055, 2°C by 2085, and 3°C by 2100, respectively.

Improved livelihoods, carbon sequestration, biodiversity preservation, and climate resilience are just a few benefits of NBS. The Millennium Ecosystem Assessment (MEA, 2005) states that NBS offer several other benefits besides mitigating and adapting to changing climate. By preserving natural ecosystems and providing habitat for a range of species, these solutions support biodiversity conservation. They also provide important ecosystem services for human health like pollination, water purification, and soil nutrient cycling. Additionally, NBS also provide better air quality, disease prevention, and recreational opportunities. Chen et al. (2023) highlighted the potential of leisure agriculture as an effective NBS in climate-vulnerable watersheds of northeastern Taiwan. Their findings suggest that adopting a recreational farming business model can effectively enhance farm profitability and adaptability to climate change. According to Lokidor et al. (2024), NBS has the ability to diminish the effects of climate change, lower the risk of flooding, and offer extra social advantages in East Africa. In urban and peri-urban areas, NBS will support urban greening, reduce GHG emissions, improve climate change resilience, promote biodiversity, and lessen pollution (Mathew et al., 2023; Artmann & Sartison, 2018).

The execution of NBS is not without its challenges. These include the requirement of careful planning and implementation, the possibility of clashes with other land uses, and the need for long-term monitoring and evaluation. However, the potential benefits of NBS far outweigh these challenges. Therefore, a comprehensive review of existing literature was conducted on NBS and their potential for achieving a net-zero future with the following objectives: (i) To find out the various types of nature-based solutions in achieving a net-zero future, and (ii) To identify the challenges and opportunities for implementing nature-based solutions.

Types of NBS for Net Zero Future

The NBS include a broad range of activities that use nature's power to address societal and climate-related issues. In order to benefit both people and the environment, they prioritise preserving, repairing, and maintaining natural and altered ecosystems in a sustainable manner. They are an effective technique for removing GHG from the atmosphere and storing them in biomass. Cost-effective climate mitigation potential of NBS consists of various natural pathways on land. Through avoided GHG emissions and enhanced carbon sinks from the protection, restoration, and management of terrestrial ecosystems, NBS could save 10 Gt CO_2 equivalents per year (Girardin et al., 2021). Griscom et al. (2017) proposed that NBS could eliminate up to 37% of annual GHG emissions by 2030, helping to keep global warming below 2°C. For a net-zero future, the following are some examples of several NBS types:

- **Forest Conservation and Restoration:** This includes protecting existing forests, restoring degraded forests, and planting new trees. Forest stores the absorbed atmospheric CO_2 in their biomass. Healthy forests are essential for retaining water and conserving soil, which increases drought resistance. Afforestation and avoided deforestation have the capacity to sequester 2-6 Gt CO_2 annually (Griscom et al., 2017). A 30-year-old agroforestry project in Sierra Leone saves 0.5 million tonnes of carbon each year through sequestration and avoiding deforestation (Girardin et al., 2021).

- **Coastal and Marine Ecosystem Protection:** Healthy coastal ecosystems like mangroves and seagrasses, can help to protect shorelines from erosion and storm surges. Mangroves and seagrasses effectively sequester carbon in their biomass and buffer coasts against climate impacts (Macreadie et al., 2022). Mangrove forests in eastern India shielded coastal areas from cyclones better than man-made barriers (Badola & Hussain, 2005). Blue carbon ecosystems, such as salt marshes, mangrove

forests, and seagrass meadows, are essential for sequestering carbon at various scales (Alongi, 2023).

- **Wetland Restoration:** Wetlands reduce the risk of flooding by acting as organic sponges that absorb floodwaters. According to Lal (2004), wetlands are exceptionally good at storing carbon from the atmosphere. Mitigating climate change can be achieved by restoring wetlands that have been degraded or drained.

- **Sustainable Land Management:** Healthy soils have the capacity to store large amounts of carbon. Increased soil carbon sequestration in agricultural fields can be achieved by better soil management practices like planting cover crops and practicing conservation tillage (Lal et al., 2015).

- **Urban Greening:** Planting trees and creating green spaces in cities can improve air quality, reduce the effects of the urban heat island phenomenon, and sequester CO_2 (Mathew et al., 2023). By growing food within city limits, urban agriculture has the potential to lower GHG emissions by shortening the food transportation distance and using soilless farming methods (Artmann & Sartison, 2018).

Challenges and Opportunities

The NBS are gaining traction as a powerful tool in the fight against climate change and achieving a net-zero future. These strategies leverage the natural world's ability to absorb CO_2 and provide other environmental benefits. Like every approach, NBS has its own set of challenges and opportunities.

Challenges

- **Scaling Up:** Implementing NBS on a large scale to have a global impact requires substantial investment and long-term planning.

- **Land-Use Competition:** Finding suitable land for NBS projects can be challenging, especially with competing demands for agriculture and development.

- **Monitoring and Measurement:** Accurately measuring the carbon sequestration and other benefits of NBS projects remains an ongoing challenge.

- **Sustainability Concerns:** The NBS projects need careful design and management to avoid unintended consequences, such as displacing local communities or disrupting existing ecosystems.

Opportunities

- **Carbon Capture:** Forests, wetlands, and coastal ecosystems act as natural carbon sinks, removing GHG from the atmosphere. NBS like forest restoration and mangrove protection can significantly enhance this sequestration.

- **Multiple Benefits:** NBS offer a holistic approach by tackling climate change in addition other environmental issues. Restoring wetlands can reduce flood risks, while protecting coastal ecosystems provides natural barriers against storms.

- **Biodiversity Boost:** NBS that focus on habitat restoration and ecosystem protection can lead to a significant increase in biodiversity, promoting a healthier and more resilient environment.

- **Economic Growth:** NBS projects can create new jobs in areas like conservation, sustainable forestry, and ecotourism.

Overall, NBS present a promising avenue for achieving a net-zero future. By addressing the challenges and maximizing the opportunities, we can leverage the power of nature to counteract global warming and create a more sustainable future.

Conclusions

NBS offer an effective and diverse approach to achieving a net-zero future, along with significant co-benefits for human welfare and biodiversity. NBS can offer affordable solutions for biodiversity conservation, climate adaptation, and mitigation by utilizing the forces of nature. NBS has a huge potential to help achieve net-zero emissions. Overcoming current obstacles and combining NBS with other mitigating techniques are necessary to realise this potential. To create the foundation for a net-zero future, we must make research investments, create reliable monitoring systems, and guarantee the fair application of NBS as we progress. Through a comprehensive strategy that integrates policy support, community participation, and technical breakthroughs, we can accelerate the adoption of NBS and create a more resilient and environmentally friendly future for everybody. The use of NBS is

suggested as a practical means of reaching net-zero emissions. Making the most of natural resources has the potential to reduce global warming, boost biodiversity, and promote human welfare. Governments, companies, communities, and civil society must work together to fully realise the potential of NBS and solve the related issues. It is believed that investing in NBS will help create a more stable and sustainable future for coming generations.

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Biofertilizers: A Pathway to Ensuring Food Security and Enhancing Food Safety

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Abstract

Biofertilizers have emerged as a promising avenue in agricultural science, offering sustainable solutions to address the challenges of food security and food safety. Biofertilizers, comprising beneficial microorganisms such as bacteria, fungi, and algae, play a crucial role in improving soil fertility, enhancing nutrient availability, and promoting plant growth. Through mechanisms such as nitrogen fixation, phosphate solubilization, and production of plant growth-promoting substances, biofertilizers contribute to increased crop yields, improved crop quality, and reduced dependency on chemical fertilizers. The utilization of biofertilizers offers several advantages in terms of environmental sustainability and agricultural productivity. By fostering beneficial microbial communities in the soil, biofertilizers help restore soil health, mitigate environmental degradation, and reduce the adverse impacts of chemical inputs on ecosystems. Additionally, biofertilizers contribute to the development of resilient cropping systems, capable of withstanding biotic and abiotic stresses, thus enhancing the overall stability of food production systems. Furthermore, the application of biofertilizers aligns with the principles of organic and sustainable agriculture, promoting ecological balance and minimizing the ecological footprint of agricultural activities.

Introduction and Importance

In the face of global population growth and climate change, ensuring food security and enhancing food safety have emerged as paramount challenges for the agricultural sector. Traditional agricultural practices reliant on chemical fertilizers and pesticides have led to environmental degradation, soil erosion, and health concerns associated with chemical residues in food. In this context, the utilization of biofertilizers presents a promising pathway towards sustainable agriculture, addressing the dual objectives of food security and safety. Biofertilizers, derived from living organisms such as bacteria, fungi, and algae, offer eco-friendly alternatives to conventional inputs, promoting soil health, crop productivity, and food quality.

Enhancing Soil Health and Fertility: Biofertilizers harbor a diverse array of beneficial microorganisms that play pivotal roles in nutrient cycling, soil enrichment, and organic matter decomposition. Nitrogen-fixing bacteria, such as Rhizobium, Azotobacter, and Azospirillum, establish symbiotic associations with plant roots, facilitating nitrogen uptake and enhancing soil fertility (Bashan et al., 2016). Similarly, mycorrhizal fungi form mutualistic relationships with plants, improving nutrient absorption, particularly phosphorus, and enhancing soil structure (Smith & Read, 2008). Through their multifaceted activities, biofertilizers contribute to the restoration of soil health and fertility, laying the foundation for sustainable agricultural systems.

Increasing Crop Productivity: The application of biofertilizers has been shown to enhance crop yields while reducing the dependency on synthetic inputs. Beneficial microorganisms in biofertilizers exert plant growth-promoting effects by producing phytohormones, solubilizing nutrients, and enhancing stress tolerance mechanisms (Glick, 2012). Additionally, biofertilizers exhibit biocontrol properties against phytopathogens, thereby suppressing disease incidence and promoting plant health (Lugtenberg & Kamilova, 2009). Recent advancements in microbial consortia formulations have further optimized nutrient use efficiency and crop productivity across diverse agroecosystems (Nadeem et al., 2014).

Promoting Food Safety and Quality: One of the critical aspects of biofertilizers is their role in ensuring food safety and quality. Unlike chemical fertilizers, biofertilizers do not leave behind harmful residues or contribute to soil and water contamination, thereby minimizing environmental risks (Egamberdieva & Adesemoye, 2016). Moreover, the enrichment of soil microbiota through biofertilizer application enhances soil suppressiveness against plant pathogens, reducing the reliance on chemical pesticides and mitigating risks associated with chemical residues in food (Mazzola, 2004). By promoting healthy soil-plant-microbe interactions, biofertilizers contribute to safer and more nutritious food production systems.

Types of Biofertilizers

1. **Nitrogen-Fixing Biofertilizers:** Nitrogen-fixing bacteria are the most common type of biofertilizers. They have the ability to convert atmospheric nitrogen (N_2) into a usable form, such as ammonia (NH_3) or nitrates (NO^{3-}), through a process called nitrogen fixation. Examples of nitrogen-fixing bacteria include:
   - **Rhizobium:** Symbiotically associates with leguminous plants to form root nodules where nitrogen fixation occurs.

- **Azotobacter:** Free-living soil bacteria that fix atmospheric nitrogen and enhance nitrogen availability in the soil.
- **Azospirillum:** Fixes atmospheric nitrogen and promotes root growth, especially in non-leguminous plants (Bashan *et al*., 2010).

2. **Phosphorus-Solubilizing Biofertilizers:** Phosphorus is an essential nutrient for plant growth, but it often exists in insoluble forms in soil. Phosphorus-solubilizing microorganisms help in converting insoluble phosphorus into soluble forms, making it readily available to plants (Gupta *et al*., 2008). Examples include:
   - **Bacillus megaterium:** Solubilizes phosphorus through the secretion of organic acids.
   - **Pseudomonas striata:** Produces organic acids and enzymes that solubilize insoluble phosphates.

3. **Potassium-Releasing Biofertilizers**: Potassium (K) is vital for plant growth and stress tolerance. Certain microorganisms assist in releasing potassium from minerals and organic matter in the soil, thus increasing its availability to plants. Examples include:
   - **Bacillus mucilaginous:** Produces organic acids that release potassium from minerals and soil particles.
   - **Klebsiella pneumonia:** Enhances potassium availability through the production of siderophores and organic acids.

4. **Symbiotic Biofertilizers:** Symbiotic biofertilizers form mutualistic relationships with plants, benefiting both the microorganism and the plant. Examples include:
   - **Mycorrhizal fungi:** Forms symbiotic associations with plant roots, facilitating nutrient uptake, especially phosphorus, and enhancing plant growth and stress tolerance.
   - ***Frankia*:** Forms nodules in the roots of certain non-leguminous plants, fixing atmospheric nitrogen and improving soil fertility.

5. ***Algal Biofertilizers*:** Certain species of algae contribute to soil fertility by fixing atmospheric nitrogen and synthesizing organic matter. Additionally, they enhance soil structure and water retention capacity (Pander *et al*., 2014). Examples include:
   - ***Anabaena*:** A nitrogen-fixing cyan bacterium that forms symbiotic associations with certain plants, contributing nitrogen to the soil.
   - ***Chlorella*:** Produces organic matter and growth-promoting substances, improving soil fertility and plant growth.

The Role of Biofertilizers in Soil Health

Soil health is vital for sustainable agriculture as it directly impacts crop productivity and environmental sustainability. Traditional agricultural practices often rely heavily on synthetic fertilizers, which can degrade soil health over time due to their chemical composition and long-term effects (Verma *et al*., 2019) In recent years, there has been growing interest in biofertilizers as an eco-friendly alternative that can enhance soil health while promoting sustainable agricultural practices. Biofertilizers contain beneficial microorganisms that facilitate nutrient uptake by plants, improve soil structure, and suppress soil-borne diseases (Khan *et al*., 2019).

Enhancing Soil Fertility: Biofertilizers play a crucial role in enhancing soil fertility by fixing atmospheric nitrogen and solubilizing phosphorus, making these essential nutrients available to plants in a form they can readily absorb. Nitrogen-fixing bacteria such as *Rhizobium*, *Azotobacter*, and *Azospirillum* form symbiotic relationships with leguminous plants, converting atmospheric nitrogen into ammonia, which can be utilized by plants. Similarly, phosphate-solubilizing bacteria like Bacillus and Pseudomonas release phosphorus from insoluble compounds in the soil, improving its availability for plant uptake.

Improving Soil Structure: In addition to nutrient enrichment, biofertilizers contribute to improving soil structure by enhancing aggregation, porosity, and water-holding capacity. Mycorrhizal fungi, for instance, form mutualistic associations with plant roots, extending their reach into the soil and increasing nutrient uptake efficiency. These fungi also secrete glomalin, a glycoprotein that binds soil particles together, improving soil stability and structure. As a result, soils treated with biofertilizers are less prone to erosion, compaction, and nutrient leaching, leading to sustained fertility and productivity.

Suppressing Soil-borne Diseases: Another significant benefit of biofertilizers is their ability to suppress soil-borne diseases through competitive exclusion, antibiosis, and induced systemic resistance mechanisms. Certain strains of beneficial bacteria and fungi colonize the rhizosphere, outcompeting pathogenic organisms for nutrients and space. Additionally, they produce antimicrobial compounds that inhibit the growth of harmful pathogens, thus reducing disease incidence in crops. Furthermore, biofertilizers stimulate the plant's immune response, priming it to resist infections and tolerate environmental stresses effectively.

Environmental Sustainability: The use of biofertilizers promotes environmental sustainability by reducing the dependence on synthetic chemicals and minimizing adverse environmental impacts. Unlike chemical

fertilizers, which can accumulate in the soil, water bodies, and food chains, biofertilizers are biodegradable and pose minimal risks to ecosystems and human health. Moreover, their application reduces greenhouse gas emissions associated with the production and use of synthetic fertilizers, contributing to climate change mitigation efforts.

Applications of Biofertilizers in Different Crops

Biofertilizers have gained significant attention in modern agriculture due to their ability to enhance soil fertility and promote sustainable farming practices. Unlike chemical fertilizers, biofertilizers contain living microorganisms that can fix atmospheric nitrogen, solubilize phosphorus, and enhance nutrient uptake by plants. This article explores the applications of biofertilizers in various crops, highlighting their benefits and contributions to crop productivity.

- **Leguminous Crops:** Leguminous crops such as soybeans, peas, and lentils have a symbiotic relationship with nitrogen-fixing bacteria, particularly Rhizobium species. These bacteria colonize the root nodules of leguminous plants and convert atmospheric nitrogen into a form that can be readily utilized by the host plant. Application of Rhizobium-based biofertilizers can significantly reduce the dependency on synthetic nitrogen fertilizers, leading to cost savings for farmers while improving soil health and reducing environmental pollution (Sahoo *et al*., 2018).

- **Cereal Crops:** Biofertilizers also play a crucial role in cereal crop production, including rice, wheat, maize, and barley. *Azotobacter* and *Azospirillum* species are commonly used biofertilizers in cereal cropping systems. These nitrogen-fixing bacteria colonize the rhizosphere of cereal crops and contribute to nitrogen nutrition. Additionally, phosphate-solubilizing bacteria such as Bacillus and Pseudomonas spp. enhance phosphorus availability in the soil, promoting root growth and nutrient uptake in cereal crops.

- **Oilseed Crops:** Oilseed crops like sunflower, canola, and sesame can benefit from biofertilizer applications, particularly those containing phosphate-solubilizing and nitrogen-fixing microorganisms. Studies have shown that inoculation with biofertilizers improves seed yield, oil content, and nutrient uptake efficiency in oilseed crops. Furthermore, the use of biofertilizers can mitigate soil degradation associated with intensive cultivation practices, thereby promoting sustainable oilseed production (Kumar and Verma. 2018).

- **Vegetable Crops:** Vegetable crops require optimal nutrient levels for vigorous growth and high-quality yield. Biofertilizers offer a natural and environmentally friendly approach to meet the nutrient demands of vegetable crops. Rhizobium, Azotobacter, and phosphate-solubilizing bacteria are commonly applied to vegetable crops such as tomatoes, peppers, and cucumbers. Biofertilizer application enhances soil fertility, improves nutrient availability, and promotes root development, leading to increased vegetable yields and improved crop quality.

- **Fruit Crops:** Fruit crops, including citrus, apple, banana, and mango, can benefit from biofertilizer applications throughout their growth stages. Biofertilizers containing nitrogen-fixing bacteria, such as Azotobacter and Rhizobium, promote healthy root development and improve nitrogen assimilation in fruit trees. Moreover, phosphate-solubilizing bacteria enhance phosphorus uptake, which is essential for fruit set, development, and ripening. Incorporating biofertilizers into fruit crop management practices can improve soil fertility, reduce nutrient leaching, and enhance fruit yield and quality.

Conclusion

Biofertilizers represent a promising strategy for sustainable agriculture, offering multifaceted benefits in terms of soil health improvement, crop productivity enhancement, and food safety assurance. By harnessing the potential of beneficial microorganisms, we can pave the way towards resilient and environmentally conscious food systems, thereby addressing the dual challenges of feeding a growing population while safeguarding natural resources for future generations.

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Studies the Effect of Different Media used for Growth and Development of Horticultural Crops

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Abstract

Due to the rapid pace of urbanization, industrialization, and the melting of icebergs, there is an anticipated significant decline in arable land available for cultivation—a direct consequence of global warming. Despite efforts to increase fertilizer treatment levels, agricultural production has once again surpassed the threshold of soil fertility saturation. Various factors exacerbate this situation, including poor soil fertility, frequent droughts, unpredictable climate and weather patterns, rising temperatures, river pollution, inadequate water management leading to substantial water wastage, and declining groundwater levels. These challenges collectively threaten the sustainability of traditional soil-based agriculture. This study examines the impact of various growth media on the growth, development, and nutrient absorption of Solanaceous crops, particularly focusing on solanaceous crop. Through controlled experimentation, the effects of different growth mediums on plant vitality, yield, and nutrient uptake efficiency are analysed. Findings from this research contribute to a deeper understanding of optimal cultivation practices for Solanaceous crops, offering insights that can enhance agricultural productivity and sustainability in the context of changing environmental conditions. Nursery cultivation is a well-established and widely practiced activity encompassing the growth of diverse plant materials, including seedlings, saplings, trees, and shrubs. The growing medium plays a crucial role in facilitating the development of young plant roots and aiding in nutrient absorption while maintaining a balance between water and air through pore spaces, thereby supporting overall plant growth. Two primary types of growing media exist in the market: soil-based and soilless (or organic-based). Soilless media, comprising organic materials like compost, peat, and cocopeat blended with inorganic matter; offer an alternative to traditional soil-based media, which incorporate elements such as perlite, pumice, and vermiculite. While organic media may not be universally accessible, soil-based options, such as combinations of various soil textures with vermicompost, present viable alternatives, particularly in resource-constrained environments.

Keywords: Vermicompost, vermiculite, perlite, horticultural crop,media, growth

Introduction

Nursery cultivation involves growing various plant materials, such as seedlings, saplings, trees, and shrubs, and selecting the right growing medium is vital for success. The medium supports root development, nutrient absorption, and maintains the crucial water-air balance. Two primary types of growing media exist: soil-based and soilless. Soil-based options blend organic materials like compost or peat with inorganic matter, while soilless mediums incorporate inorganic elements like perlite or vermiculite.

Soil-based alternatives are often more accessible, especially in resource-constrained areas, and can include a mix of soil textures with vermicompost for optimal water retention and pore structure. Proper storage and handling of the medium are essential to ensure its quality and effectiveness.

Growing media play a significant role in enhancing crop yield by providing porosity, water retention, aeration, and pH adjustment for nutrient absorption. Soil, being cost-effective and readily available, is commonly used, often enriched with organic matter like vermicompost or perlite for essential nutrients.

Soilless cultivation methods gained popularity in the 1980s due to challenges like soil-borne diseases and variable soil quality. Perlite and vermiculite are widely utilized for their drainage and water-holding capacity. They are safe, non-toxic, and reasonably priced, making them popular choices in horticulture.

The choice of growing medium influences seed germination and subsequent plant development, affecting seedling quality. Perlite and vermiculite are commonly used for their drainage and water retention properties.

Researchers anticipate market growth driven by the benefits of soilless cultivation and global population increase. The review aims to disseminate research on the impact of growing media on horticultural cultivation, covering various subjects like physiology, nutrition, and waste management, to provide valuable insights and advancements in horticultural practice.

The present study has been taken based on following hypothesis

Farmers have been growing vegetable in the soil for past many years and due to continuous monoculture under polyhouse soil health have deteriorated considerably, mainly due to soil borne diseases, which costs major portion of

expenditure on crop production, therefore, soilless media that can support plant growth without affecting yield is required. The best remedy for the problem of poor soil health is growing the high value cash crops in soil less media which is pre-sterilized and is devoid of any diseases and pests. The media when supplied with enough water and fertilizer may yield better than soil with high quality produce. So, there is need to select suitable potting mixture/ medium with better characteristics among the different medias available in the market for production of tomato under poly-houses which is highly remunerative crop for the farmer across India. The standardization of best media may help in recommending the same to the farmers which will further improve economic viability of producing vegetable crops under protected cultivation (Fu et al., 2017).

Importance of Growing Media

Growing media serve as the substrate in which plants anchor their roots and access essential nutrients, water, and oxygen. The selection of appropriate growing media is crucial as it directly influences the physical, chemical, and biological properties of the root environment. Factors such as water retention, aeration, nutrient availability, pH level, and disease resistance are key considerations when choosing the optimal growing media for horticultural crop production. Here are some key aspects highlighting the importance of growing media:

- **Physical Support:** Growing media provide structural support to the plant's root system, anchoring it in place and preventing the plant from toppling over. This support is crucial for the development of a healthy root system, which in turn contributes to overall plant vigor and stability. (Gislerød & Nelson, 1990).

- **Nutrient Availability:** Growing media act as a reservoir for essential nutrients that are necessary for plant growth and development. These nutrients include macronutrients such as nitrogen (N), phosphorus (P), potassium (K), as well as micronutrients like iron (Fe), manganese (Mn), and zinc (Zn). The growing media release these nutrients to the plant roots as needed, ensuring optimal nutrient uptake and utilization. (Epstein, 1972).

- **Water Retention:** Growing media have the capacity to retain moisture, ensuring a consistent supply of water to plant roots. This is particularly important during dry periods or in regions with irregular rainfall patterns. (Resh,2012)

- **Aeration:** Proper aeration of the root zone is essential for root respiration and nutrient uptake. Growing media with good aeration properties allow oxygen to penetrate the root system, facilitating aerobic respiration and preventing root suffocation. Adequate aeration also helps to prevent the buildup of harmful anaerobic conditions that can lead to root diseases. (Klaring & Zude-Sasse, 2017).

- **pH Buffering:** Growing media can influence the pH of the root environment, either by acting as a buffer or by directly affecting the pH of the irrigation water. Maintaining the appropriate pH level is critical for optimal nutrient availability and uptake, as it affects the solubility of minerals in the soil solution. Growing media with proper pH buffering capacity help to stabilize the root environment and prevent nutrient deficiencies or toxicities (Marschner, 2011)

- **Disease Control:** Certain growing media may have inherent properties that help suppress soil-borne pathogens or pests, reducing the risk of plant diseases. Additionally, sterile or pasteurized growing media can minimize the introduction of harmful pathogens into the root zone, promoting plant health and reducing the need for chemical interventions. (Bélanger, & Labbé, 2002).

Overall, the choice of growing media has a profound impact on plant growth, productivity, and health. Selecting the appropriate growing media based on factors such as plant species, environmental conditions, and cultivation practices is essential for maximizing crop yields, optimizing resource use efficiency, and promoting sustainable agriculture.

Different Types of Media Used For Horticultural Crops for Their Growth

Horticultural crops are among the most widely cultivated and consumed vegetables globally, making them a vital crop for food security and economic prosperity. The success of tomato cultivation is heavily dependent on various factors, with the choice of growing media playing a pivotal role in determining plant growth, development, and yield. In this chapter, we delve into the profound impact of different growing media on salanacous crop growth and explore the factors influencing these effects. (Smith, J., and Jones, 2019).

Soil-Based Media: Traditional soil-based growing media have been widely used for tomato cultivation. Soil provides a stable physical structure for root anchorage and offers a reservoir of nutrients essential for plant growth. However, soil quality can vary significantly, impacting plant growth and yield.

Factors such as soil texture, structure, fertility, and pH level influence nutrient availability and water retention, thereby affecting tomato growth. Soil-borne diseases and pests also pose significant challenges in soil-based cultivation systems. (Gislerød, & Nelson, 1990).

Peat Moss and Coco Coir: Peat moss and coco coir are popular alternatives to traditional soil-based media. These organic substrates offer excellent water retention properties while providing adequate aeration to the root zone. Peat moss is derived from decomposed plant material found in peat bogs, whereas coco coir is obtained from the fibrous husks of coconut shells. Both media are lightweight, sterile, and pH neutral, making them ideal for hydroponic and container-based tomato cultivation. However, concerns about environmental sustainability and peat bog depletion have prompted growers to explore alternative options. (Resh, 2012)

Perlite and Vermiculite: Perlite and vermiculite are inorganic growing media commonly used as soil amendments to improve soil structure and drainage. Perlite is a volcanic glass that has been expanded by heating, creating a lightweight, porous material that promotes aeration and drainage in the root zone. Vermiculite, on the other hand, is a hydrated laminar mineral that holds water and nutrients, enhancing soil moisture retention. These media are often used in soilless growing systems such as hydroponics and container gardening to provide a well-balanced root environment for tomato plants. Klaring & Zude-Sasse,2017).

Hydroponic Systems

Hydroponic systems utilize nutrient-rich water solutions as the growing medium, eliminating the need for soil altogether. Tomatoes grown hydroponically exhibit rapid growth rates and high yields due to direct access to essential nutrients and optimized root oxygenation. Various hydroponic techniques such as nutrient film technique (NFT), deep water culture (DWC), and aeroponics offer different advantages and challenges for tomato cultivation. However, hydroponic systems require precise management of nutrient concentrations, pH levels, and water quality to ensure optimal plant growth and productivity. (Marschner, 2011)

Overall, the choice of growing media has a profound impact on plant growth, productivity, and health. Selecting the appropriate growing media based on factors such as plant species, environmental conditions, and cultivation practices is essential for maximizing crop yields, optimizing resource use efficiency, and promoting sustainable agriculture.

Effect of Different Growing Media on Horticultural Crops for Their Growth and Development

Various researchers have conducted studies to determine optimal growing media for nursery cultivation, yielding significant findings. Gupta et al. (2023) identified T9 and T11 treatments as effective for tomatoes, promoting root development and foliage growth. Khedar et al. (2023) found T5 to be superior for cashew gram seedlings. Hazarika et al. (2022) and Mahala and Sharma (2022) demonstrated the efficacy of specific media for cabbage, brinjal, and chili seedlings.

Other studies emphasized the importance of perlite-containing media for potato (Hajiaghaei Kamrani et al., 2019), strawberries, and pomegranates (Thakur & Style et al., 2018; Rajkumar et al., 2017), and coconut coir for tomatoes (Xiong et al., 2017; Truong et al., 2017). Additionally, Mathowa et al. (2016), Rekani et al. (2016), and Atif et al. (2016) highlighted the effects of different media on tomato and sweet pepper seedling growth.

Further studies explored optimal media for bell peppers (Aslani et al., 2015), peppers (Xiang et al., 2015), and sweet peppers (Sayel-El et al., 2015). Nagaraj et al. (2015) and Hafshjani et al. (2015) investigated media combinations for capsicum growth, with promising results. Collectively, these studies offer insights into selecting suitable growing media for various crops, aiding in optimizing plant growth, yield, and resource use efficiency in agriculture.

Conclusion

On the basis of above-mentioned review, it is concluded that rooting media, not only affects the percentage of cuttings rooted, but also the quality of roots produced and rooting medium has four basic functions: (i) It holds the cuttings in place, (ii) It supplies moisture to the cuttings, (iii) It supplies oxygen to basal portion of cuttings, (iv) It also provides nutrients. But the success of rooting is depending to environmental factors and medium to be used. So we have to find out the proper growing media.

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Nutritional Fortification Techniques in Processed Vegetable Products

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Abstract

Nutritional fortification of processed vegetable products involves the deliberate addition of essential nutrients to enhance their nutritional value and address specific dietary deficiencies. This practice is crucial in combating malnutrition and improving the overall health outcomes of consumers. Fortification techniques are employed to enrich processed vegetable products with key macronutrients like proteins, carbohydrates, and fats, as well as micronutrients such as vitamins and minerals. Vegetable processing, especially in the case of tomatoes, involves a myriad of techniques aimed at preserving, enhancing, and diversifying the utility of this versatile crop. This abstract delves into the various methods employed in the processing of tomato and other vegetable crops, highlighting their significance in ensuring food security, reducing postharvest losses, and meeting consumer demand for convenient food products. The processing journey typically begins with a careful selection of ripe and high-quality tomatoes. Sorting and grading are crucial initial steps to remove damaged or defective fruits. These processed forms are then utilized in a myriad of food products such as sauces, soups, juices, and ketchups. Tomato processing also involves preservation methods like canning, freezing, or dehydration to extend shelf life and maintain nutritional quality. Canning involves sealing tomatoes in airtight containers after heat treatment to destroy microorganisms, ensuring long-term preservation. Freezing preserves tomatoes by halting enzymatic activity and microbial growth, albeit requiring cold storage. Dehydration, achieved through sun drying or mechanical means, reduces moisture content, thus enhancing shelf stability. Furthermore, tomato byproducts, such as peels and seeds, are not wasted but can be utilized in various ways. They can be processed into extracts for supplements, utilized in animal feed, or converted into biofuels, contributing to sustainability efforts. In conclusion, the processing of tomatoes and other vegetable crops encompasses a wide array of techniques aimed at optimizing their utility, shelf life, and nutritional value.

Introduction

Tomatoes (*Solanum lycopersicum* L.), formerly deemed inedible, have evolved into one of the most well-liked and extensively used vegetable crops.

They lead the processed vegetable category, with various products such as puree, sauce, ketchup, soup, juices, and peeled tomatoes being manufactured on a large scale. These items are highly favored as food ingredients, contributing to a thriving multimillion dollar industry focused on cultivating processed tomatoes globally. Consequently, processed tomatoes possessing distinct characteristics hold significant importance within the tomato sector across developed nations. While the processing of tomatoes remains relatively less prominent in India, there exists the substantial potential to process this commodity into a paste for foreign exchange earnings.

Comprising 11% of the global production share, India stands out as a significant tomato producer, second only to China. Surprisingly, less than 1% of India's tomato yield undergoes processing, a stark contrast to the average 26% prevalent among the top 10 tomato-producing nations worldwide. The consumption of tomato-based processed foods within India is experiencing remarkable growth, expanding annually by over 30%, consequently fuelling a substantial demand surge for processors. This trend has also opened new avenues for product imports. Notably, Indian manufacturers specializing in tomato-based products rely heavily on importing substantial volumes of tomato pulp and paste, an endeavour burdened by high prices compounded with a 30% import duty. Despite this, indigenous paste and pulp producers struggle to maximize their operational capacities due to inadequate access to fresh, cost-effective tomatoes at required volumes. Moreover, the current varieties of tomatoes cultivated in India generally lack the quality attributes necessary for efficient processing into paste and pulp, as outlined by Subramanian in 2016. The fast-food industry in the country is experiencing robust growth due to increasing disposable incomes and the influence of Westernized food consumption patterns. Processed tomato products like tomato paste and tomato sauce play a significant role in various Indian cuisines. Factors propelling the tomato processing market in India encompass convenience, extended shelf life, urbanization, changing dietary preferences, and the expansion of organized retail establishments. Processed tomato products, including tomato juice, pulp, puree, paste, powder, sauce, ketchups, chutneys, among others, find wide-ranging applications across households, the food processing industry, snack foods, hotels, restaurants, and fast-food outlets.

What Are Processing Tomatoes? Are They Different From Regular Tomatoes?

Processing tomatoes undergo various preservation methods like canning, dehydration, and conversion into products such as paste, puree, pulp, ketchup, tomato sauce, and tomato juice, tailored for both commercial and domestic

utilization. These tomatoes possess distinctive characteristics setting them apart from regular varieties:

- They feature a thick skin.
- They are harvested at the red ripe stage.
- They are picked in a single harvesting round using mechanical harvesters to retain maximum flavor.
- They exhibit durability during transportation while maintaining their ripe, red state.
- Furthermore, once these tomatoes ripen, they offer an extended shelf life.

History

The exact origin of the tomato plant remains uncertain, although speculations suggest its evolution from the prehistoric Nightshade plant millions of years ago in South America, alongside potato, tobacco, and chili peppers. The earliest tomatoes are believed to have grown as wild cherry sized berries in the South American Andes Mountains. In the early 1500s, seeds of tomatoes were sent to Spain by Padres, eventually reaching Italy. Italian cuisine enthusiasts embraced tomatoes, dubbing them "Poma amoris," which translates to love apple. This fervor led to the development of numerous tomato-based recipes that remain popular today. Contrastingly, the English initially viewed tomatoes as poisonous due to their family ties to the nightshade plant and cultivated them solely out of curiosity. In the mid1700s, English colonists introduced tomatoes to America, though they were still considered toxic until Robert Gibbon Johson bravely consumed one in the 1820s, survived, and dispelled the myth of tomatoes being deadly. The development of mechanical harvesters in the 1950s facilitated advancements in tomato cultivation, yielding varieties with tougher skins, fewer seeds, less juice, and a more rectangular shape. Tomatoes made their way to India via Portuguese explorers during the early 16th century. Flourishing in warm, sunny climates without severe frost, tomatoes thrived in Indian soils after their introduction. The crop gradually spread throughout the country and is now cherished as one of the most beloved agricultural produce. Although historical evidence is scant regarding the inception of tomato cultivation in India, it is evident that the British significantly contributed to popularizing tomatoes within the country.

Indian tomato processing market

The Indian market for processing tomatoes presents numerous opportunities for exploration within the substantial tomato processing industry. The ketchup and sauce market alone in India is valued at Rs 1,000 crore and is experiencing an annual growth rate of around 20%. The demand for processed

tomato products is considerable, with a particularly positive outlook for specially packaged tomato sauce in both local and external markets. This demand is being bolstered by increasing urbanization and rising living standards in cities and rural areas, fostering a steady uptick in the consumption of tomato-based products. Tomato products play a pivotal role as key ingredients in ready-to-eat and fast food items, enhancing flavors and serving as essential taste enhancers. Notably, the American food processing giant, H. J. Heinz Company, operates across six continents and markets its products in over 200 countries and territories globally. Currently, prevalent brands like MAGGI and KISSAN dominate the ketchup/puree market, especially in urban areas of India. Prominent tomato-producing states in India include Bihar, Karnataka, Uttar Pradesh, Orissa, Andhra Pradesh, Maharashtra, Madhya Pradesh, and West Bengal. Given the widespread availability of raw materials across the country, establishing a small-scale tomato processing unit proves to be a profitable venture. Processed tomato products exhibit promising export potential, particularly in regions like the Middle East, attracting numerous operations in the small-scale sector nationwide. Embarking on a small-scale tomato processing venture, focused on a specific product, offers a financially feasible investment opportunity. The Government of India extends support to small-scale producers through the MSME scheme under the MSMED Act of 2006, facilitating the establishment of enterprises engaged in the processing, production, and preservation of goods and commodities. A Tomato Processing Plant with a production capacity of 3300 Units/Day may require an estimated investment of approximately Rs. 56 Lakhs. This investment encompasses Rs. 13 Lakhs for plant and machinery, Rs. 28.0 Lakhs as working capital and additional expenses. Such a small-scale project has the potential to yield returns of 73.89%, with a breakeven point of 44.50%. Please note that the actual project costs could vary based on changing assumptions.

General Industrial Processing Procedure for Different Product

Gould (1992) notes that while tomatoes are frequently enjoyed fresh, more than 80% of tomato consumption stems from processed products like juice, paste, puree, ketchup, and sauce. Processing encompasses a collection of interconnected tasks or methods that collectively enhance the product's value. Processing involves grading, washing, blanching, slicing, peeling etc. Some of the processing methods are explained below

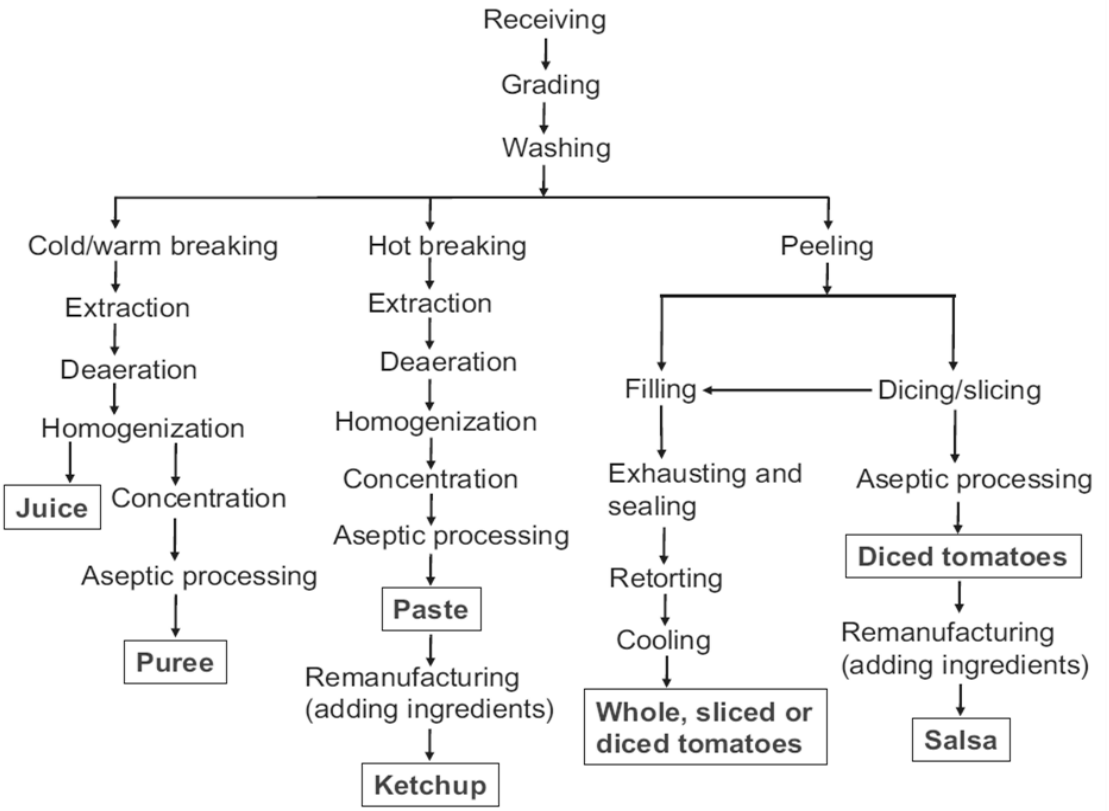


Figure: Different tomato processing methods

Processed Products of Tomato

There are numerous processed products of tomato which are now an integral part of our diet. The most popular processed products of tomato are

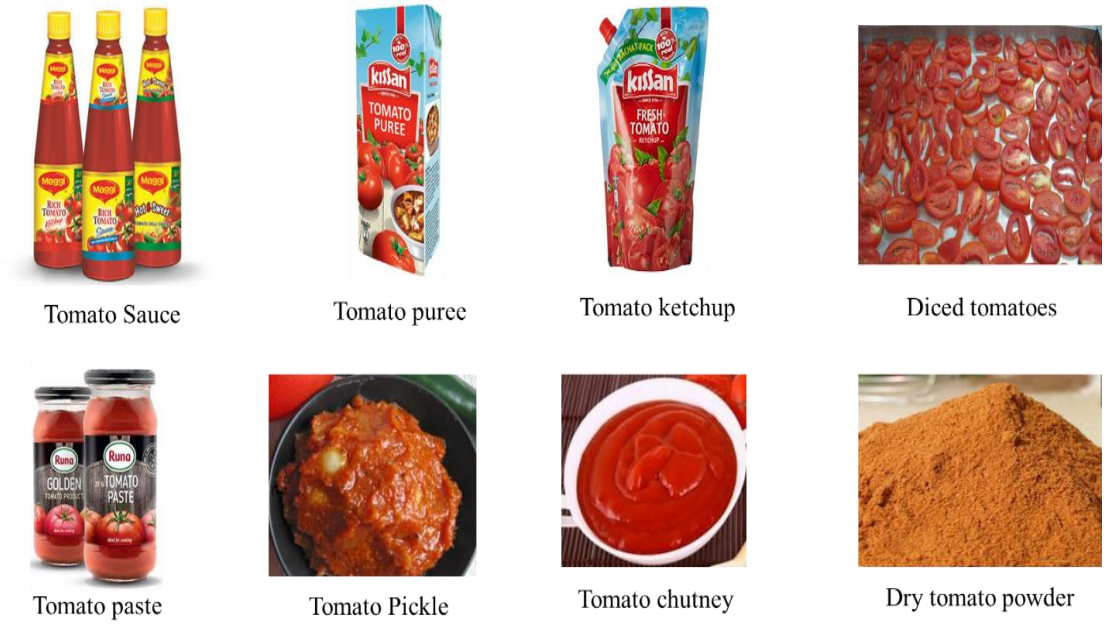


Figure: Different processed products of tomato.

Indian Export of Processed Products

India commenced tomato exports in the 1970s, contributing just approximately 0.1% of total production compared to the world market export share of about 3.9%. The import of tomatoes and tomato products began in the 1980s with an initial volume of around 14 tonnes of tomato juice annually. Over the following decade, the import spectrum diversified to include peeled tomatoes, tomato paste, and tomato juice. Notably, tomato paste accounted for roughly 80% of the total import value of tomato products, with tomato juice at 13.5%, peeled tomatoes at 6%, and whole tomatoes at 0.6%. The shift to becoming a net importer of tomato paste, tomato juice, and on the brink of becoming a net importer of peeled tomatoes signifies a notable transformation from the previous net exporter status held until the 1990s. The rise in consumption and demand for processed tomato products in India indicates a substantial uptick that domestic industries are currently unable to fully satisfy.

This surge in demand for tomato-based products could be attributed to the proliferation of numerous fast food centers like McDonald's, Pizza Huts, among others across the nation, as well as evolving lifestyle and dietary patterns within the expanding population.

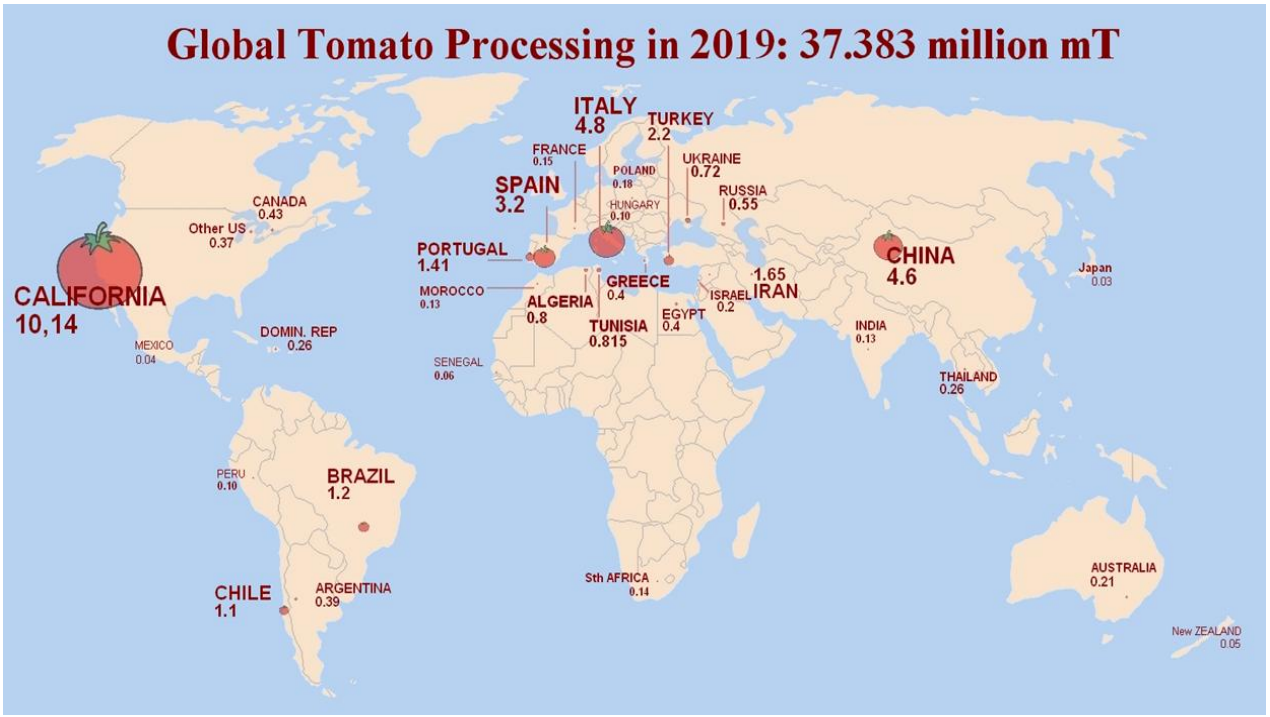


Figure: Global tomato processing in 2019

The Behavior of Nutrients during Tomato Processing

During the processing of tomatoes, various changes in product quality occur (Nasir et al. 2015) that can be either beneficial or harmful, including alterations in amino acids, acid contents, vitamins, reducing sugars, lycopene, etc., as detailed below:

- **Amino acids:** Processing tomato juice at temperatures exceeding 100°C for 20 minutes leads to a significant increase in amino acid contents due to partial hydrolysis and protein denaturation. Glutamic acid exhibits the highest increase in concentration, followed by aspartic acid, threonine, and alanine. Certain amino acids like glutamine and asparagine are completely lost during processing, converting into respective acids (Miladi et al. 1969).

- **Acids:** The acid content of tomatoes rises during juice processing. An increase in acetic acid concentration of up to 32.1% has been noted. This increase is mainly attributed to the breakdown of amino acids into their components. Moreover, elevated levels of other acids such as citric and malic have been observed in tomato juice (Miladi et al. 1969).

- **Lycopene:** During the processing and storage of tomatoes, the effect of processing on lycopene is largely stable (Leoni and Jongen 2002). Lycopene may be deteriorated by prolonged oxygen exposure, low water activity, and high processing temperatures. However, in terms of isomerization and degradation, lycopene maintains good stability in commercial manufacturing procedures.

- Reducing sugars: Several chemical processes, including caramelization, the Maillard reaction, and the synthesis of 5hydroxymethyl furfural, cause heat treatment to lower the levels of reducing sugars. Studies have shown that up to 19% of the reducing sugars in processed tomato juice are lost, depending on the processing technique used (Miladi et al. 1969).

- **Vitamins:** Ascorbic acid is particularly susceptible to destruction during tomato processing, primarily via oxidation. Factors such as dissolved copper, oxygen, enzymes, and processing temperature influence the rate of ascorbic acid oxidation. Long-term heating of tomato juice in an open air setting leads to the destruction of retinol and certain group vitamins (Leoni and Jongen 2002).

The effect of processing on sensory possessions of tomato

- **Flavor:** When compared to fresh tomatoes, processed tomatoes have a much different scent. The synthesis of new compounds or the loss of volatile compounds as a result of high processing temperatures could be the cause of this alteration. The process by which cis3hexenal becomes trans2hexenal is a major factor in the flavor degradation of tomatoes. The cooked smell of tomato products that have been processed is caused by compounds that are produced when sugars and carotenoids break down. The smell of heated tomato products is mostly attributed to dimethyl sulfide. Furthermore, upon heating, lipoxygenases—which give tomatoes their unique flavor—are broken down.

- **Color:** Tomato paste may become somewhat darker in color during processing as a result of the start of browning reactions. These processes do not result in a deterioration of quality, even though they help generate the red pigment that intensifies the red color of tomato paste. Lowering the processing pH and temperature will minimize browning reactions in tomato paste, such as the Maillard reaction and caramelization. The necessity of processing tomatoes

The tomato cultivars used for processing must meet the demanding needs of growers, processors, and consumers in terms of cost-effectiveness, nutritional value, and marketability. The following is how Schroeder (1993) summed up these needs:

- **Growers' Needs**: stable predictable productivity, high field quality, low cost of production, flexibility.

- **Processors' Requirements:** demand a high proportion of usable fruits, optimal factory yields, superior quality, cost-effectiveness, timing flexibility, processing adaptability, and consistent performance.

- **Consumers' Expectations:** prioritize nutritive value, culinary attractiveness (including texture, flavor, and color), as well as the purity and safety of the products. Consumers and growers' evolving demands and handling requirements over the past two decades, and the anticipated future changes, necessitate that newly developed cultivars surpass previously released ones not just in existing traits, but by continuously accumulating new valuable agronomic traits to meet the needs of consumers, growers, and processors. Breeding research for processing tomatoes should prioritize yield, tolerance to abiotic and biotic stresses, and fruit quality. However, combining all these traits into a single variety

is a lengthy and challenging process, often with uncertain outcomes, as many of these traits are intricate and governed by various polygenic components, with only some possibly enhanced through mutant genes (Stevens and Rick, 1986). Leveraging both conventional and molecular breeding techniques and exploiting Heterosis can help achieve the ambitious and complex breeding objectives related to processing tomatoes.

Specific breeding objectives

- **High Yield:** High yield potential is a primary goal in processing tomato breeding programs, crucial for varietal adoption, especially for improved quality traits and efficient machine harvesting.

- **Earliness:** Early ripening extends the harvest season, aiding growers in managing tomato harvests and enhancing in-plant operational efficiency for processors, particularly important in machine harvesting systems.

- **Plant Habit:** Machine harvest varieties require a determinate vine regulated by the sp gene, with modifiers controlling vine size, concentrated flowering, and reliable fruit setting.

- **Concentrated Fruit Set and High Temperature Setting Ability:** Concentrated fruit yield and maturity are essential for onetime Machine harvests, with resistance to high temperature stress during key fruit setting periods critical for successful fruit set. Utilizing germplasm variations for concentrated plant habits and earliness requires specialized breeding techniques.

- **Vine Storage of Fruit:** The capacity of fruits to ripen and remain on the vine is vital for enhancing fruit concentration and maximizing yield recovery. This process is influenced by fruit crack resistance, regulated by numerous genes found in a variety of modern cultivars.

- **Harvestability:** Efficient machine harvests rely on vine size for easy pickup and effective fruit removal, with stem retention addressed by the jointless (j2) gene. In processing tomatoes, low stem retention is preferred as pedicel retention can damage other fruit in the load and alter the processed product's flavor. Varieties with elongated fruits are typically more resistant to machine damage than round types.

- **Tolerance to abiotic and biotic stresses:** Tomato production is influenced by abiotic factors like drought, floods, salinity, and an array of

diseases including fungal, bacterial, viral, nematode infestations, and physiological disorders. Disease free tomato lines are highly valued.

- **Raw Product Improvement:** Enhancing raw product quality is a longstanding priority in processing tomato breeding. While productivity and disease resistance have historically been emphasized, improving quality traits remains essential and challenging for meeting evolving consumer and grower demands.

Fruit Quality Objectives

- Fruit Firmness: Controlled by simple genetics, firm-fruited cultivars possess higher levels of alcohol insoluble components, a thicker outer pericarp, and a smaller locular area.
- TSS: Recommended high Total Soluble Solids (TSS) content (56 °Brix) in processing tomatoes. *L. pimpinellifolium* shows TSS levels of 4.9%9.2%, while *L. chmielewskii* has around 10%.
- Sugar content: High sugar levels are preferred for processing tomatoes.
- High Solids/acid ratio and high Sugar/acid ratio should be achieved.
- Viscosity should be high.
- High lycopene and beta-carotene levels are ideal for pigmented products. The crimson gene (ogj) and high pigment gene (hp) contribute to increased lycopene for intense red coloration.
- Acidity should not be below 0.4% (Adsule et al. 1973).
- pH should be below 4.5, with values over 4.4 deemed unsuitable for standard processing methods.
- Fruit weight should be no less than 50 g.
- Other quality criteria: Desired attributes include a thick pericarp, uniform red color, smooth surface, absence of wrinkles, small core, firm flesh, preferably bilocular, uniform ripening, and ensuring fruits are flawless and disease free.

Breeding Methods for Processing Tomato

The breeding strategy for a specific species is chiefly determined by the mating system it follows. Cultivated tomatoes, being self-pollinated, are characterized by highly inbred commercial varieties that exhibit restricted genetic diversity within each cultivar. Self-pollinating plants such as tomatoes typically experience minimal genetic alterations once they are stabilized. The selection of parents plays a critical role in attaining breeding goals, requiring a comprehensive knowledge of the available germplasm reservoirs for enhancing tomatoes. The development of new cultivars is often streamlined by leveraging elite germplasm from well-adapted improved cultivars rather than unadapted

exotic varieties. Desired genes are often obtained from wild relatives of cultivated tomatoes, a process that can be time-consuming when integrating these genes into cultivated varieties. Various breeding methods for processing tomatoes will be discussed below.

Introduction Improved varieties' seeds are transferred from one ecological region to another for assessment, either for direct utilization as a variety or for incorporation into breeding crosses. For example, varieties like **Marglobe** and **Roma** were introduced from the USA. The Pure line selection is the progeny of single homozygous self-fertilized individual plants. For example

Varieties	**Importance**	**Pure line selection from**
Arka Ahuti (Sel11)	processing	Ottawa60
Arka Saurabh	processing	V685
cv. 246627	processing	UP

(https://iihr.res.in/varietiescropname/tomato; accessed on 06.06.2022)

Single seed descent method: Is a traditional method that involves selecting a single seed from each plant, aggregating these individual seeds, and planting them in subsequent generations. This approach is suitable for traits with low heritability like yield, yield components, and earliness, particularly in crops with wider spacing. In this process, one or two seeds are gathered from each F_2 plant and then bulked for growing the F_3 generation. The Single Seed Descent (SSD) system expedites the production of pure lines, which are then subjected to selection for desired characteristics.

Mass selection: Involved the transformation of IIHR674 from the UC82 line in the USA into Arka Ashish, featuring oval shaped, firm fleshed fruits with two locules, containing 10mg/100gm lycopene, suitable for processing purposes.

The **Pedigree Method:** Tracks the ancestry of an individual back to distant ancestors, useful for determining relatedness by descent and shared genetic traits. For instance, Arka Meghali is a tomato pureline resulting from the cross of Arka Vikas and IHR 554, while Pusa Ruby is a selection derived from Improved Meeruti and Sioux.

The **Back Cross Method:** Is primarily utilized to transfer specific genes into established cultivars lacking certain characteristics, particularly for disease

resistance traits like early blight, nematodes, and bacterial wilt. Continuing backcrosses are conducted with the desirable parent, emphasizing selection for the desired trait from the donor parent. By following this method, the newly developed cultivar retains the characteristics of the original parent while incorporating the improved trait.

Heterosis Breeding: Capitalizes on hybrid vigor in tomatoes, prioritizing hybrids over pure line varieties due to enhanced marketable fruit yield, resistance to biotic and abiotic stresses, and superior qualities. Notable F1 hybrids designed for processing purposes include Arka Apeksha, Arka Vishesh, Arka Ananya, IHR 674 SB X IHR 709, and Pusa Ruby.

Interspecific hybridization: Can create varieties with a natural resistance against various stresses by crossing wild relatives carrying genes for resistance and quality traits with cultivated tomatoes to incorporate the desired characteristics. A list of some wild relatives and their specific traits are given in the table below

Table: Wild relatives carrying gene for natural resistance and quality parameters

Source	**Resistance source**	**Quality**
L. peruvianum	Verticillium wilt, TLCV, Nematodes and Salinity	
L. pimpinellifolium	bacterial wilt, Fusarium wilt	colour, quality
L. hirsutum	Fusarium Wilt, *Helicoverpa* insect and Virus	
L. cheesmani	Salinity resistance	Vit C and carotene content
L. pennelli	Drought resistance and salinity resistance	
L. chmielewskii		High Sugar content

Mutation Breeding: Brings forth natural mutants in tomatoes such as *Nr* (Never ripening), *rin* (Ripening inhibitor), *nor* (non-ripening), and *alc* (slow

ripening). The ripening phase of fruit development is critical as it readies the seed for reproduction and imparts essential fruit quality attributes like color, aroma, taste, and texture for human consumption. Notable ripening-expressed mutations in tomatoes include *Rin, Cnr, Nr,* and *Nor*. While *Rin, Cnr,* and *Nr* have been extensively studied for their roles in fruit ripening regulation and quality development, limited information is available concerning the *Nor* gene. The nor mutation significantly affects ethylene synthesis, pigment biosynthesis, softening, and nutrient biosynthesis, and influences disease-resistance genes, playing a crucial role in fruit quality development (Yuan 2016).

In the domain of biotechnology

- **Antisense RNA:** targeting the Polygalactourinase (PGU) enzyme, a cell wall degrading enzyme that becomes active at ripening onset and is a major cell wall bound protein in ripe fruits, as exemplified by Flavr Savr.

- **Insect resistance:** Strategies for achieving insect resistance, such as introducing 'Bt' to combat *Helicoverpa* (fruit borer) infestations, are crucial. Breeding for enhancing storage life and processing qualities of fruits involves selecting traits like high acidity, uniform intense red color, high Total Soluble Solids (TSS), resistance to cracking, elongated fruit shape with high yield, and plants suitable for mechanical harvesting with a determinate growth habit, concentrated fruit set for singletime harvesting, and fruits with jointless pedicels.

Different tomato varieties serve specific purposes, including

Varieties such as Roma, Punjab Chuhara, Arka Ahuti, and Arka Ashish tailored for specific needs.

Selections for juicing and canning like Roma, Son Marzano, Red Top, HS110, and Italian pear.

Choices for puree preparation such as Indo Process II, Indo ProcessIII, and Rupali.

Options for making paste and ketchup like HS 101 and HS 110.
Varieties suitable for juicing like Roma, Sel11, Punjab Chhuhara, and Sel4, along with the canning variety SI 152 (Adsule et al., 1979).

These are some important tomato processing varieties.

1. **Arka Vishesh (H391)**

- Yield potential: 750800 quintals/ha
- Suitable for: processing into puree, paste, ketchup, sauce, and tomato crush
- Total Soluble Solids (TSS): 44.60 Brix
- Average fruit weight: 7075 grams
- Acidity of crushed tomato juice: 0.320.36
- pH range: 4.214.41
- Lycopene content: 8.510.5 mg/100g

2. **Arka Apeksha (H385)**

- Yield potential: 800900 quintals/ha
- Suitable for: processing into puree, paste, ketchup, sauce, and tomato crush
- Total Soluble Solids (TSS): 44.70 Brix
- Average fruit weight: 7580 grams
- Acidity of crushed tomato juice: 0.340.38
- pH range: 4.124.40
- Lycopene content: 11.1211.42 mg/100g
- Firmness: 4.054.30 kg/cm²

3. **Arka Rakshak**

- High yielding F1 hybrid with triple disease resistance (ToLCV, BW, and early blight)
- Fruit characteristics: square round, large (90100g), deep red colored, firm
- Suitable for both fresh market and processing
- Yield potential: 7580 tons/ha in 140 days

4. **Arka Ashish**

- Openpollinated variety developed for processing
- Fruit traits: oval shape, very firm, thick fleshed with 2 locules
- Excellent fruit color (lycopene content: 10mg/100g)
- Total Soluble Solids (TSS): 4.8%
- Tolerance to powdery mildew and fruit cracking
- Yield potential: 38 tons/ha in 130 days

https://iihr.res.in/varietiescropname/tomato

Achievements

Important Varieties	Important Characters
Pusa Ruby	Slightly Acidic, Good for Juice & Ketchup
LABonita	23 locules, thick pericarp, long distance transport
Punjab Chhuhara	Suitable for Canning, 23 locules
Roma	Suitable for long distance transport and processing
Vaishali	The variety shows resistance to Fusarium and Verticillium wilts, making it ideal for tomato juice preparation.
Rupali	The fruits display a deep red hue. This variety is resistant to Fusarium and Verticillium wilts, making it well-suited for processing.
Rashmi	This hybrid variety is determinate and widely adapted. The fruits are round, firm, smooth, and exhibit a vibrant coloration. It boasts resistance against Fusarium and Verticillium wilts, making it an excellent choice for processing.
Pusa Early Dwarf	It is suitable for table as well as processing purpose
Arka Saurabh (Sel- 4)	Suitable for **table** purpose & **processing.**
Arka Ahuti (Sel 11)	Plants are semi-determinate fruits oblong with 23 locules. Suitable for **processing**.
Arka Shreshta	A determinate and versatile hybrid, this variety features round, firm, and smooth fruits with vibrant coloration. Its resistance to Fusarium and Verticillium wilts enhances its suitability for processing purposes.
Flavr savr	**Delayed softening**, biotechnology
8805R	**Delayed softening**, biotechnology
Caro red	**10 time more beta carotene** than the recurrent parent, backcross method
Naveen	Early, high yielding, heterosis

(Subramanian 2016)

Conclusion

Seedless tomatoes resulting from genetic parthenocarpy offer advantages in the food processing industry as seeds do not require removal before processing. The expression of parthenocarpy in the segregating populations of all three crosses revealed the involvement of a second gene, denoted as "ii", which independently influenced the *pat2* gene responsible for controlling parthenocarpy. The inheritance patterns of parthenocarpy, stem pigmentation (pigmented/nonpigmented stem), and leaf characteristics (cut/potato leaf) did not show any genetic linkages between parthenocarpy (*pat2 pat2 ii*) and two marker genes: stem pigmentation (*aw+/aw*) and leaf character (*c+/c*).

Future prospects: The genetic improvement of tomatoes has been significantly advanced due to their unique biological characteristics and the extensive genetic variability within the genus *Lycopersicon*. Wild germplasm in tomatoes serves as a valuable resource for breeders. Historically, wild tomato relatives have primarily been utilized for disease resistance traits. However, there is potential for further exploitation of the germplasm from these wild species to develop tomato varieties with resistance to insect pests, environmental stresses, improved quality attributes, and other desirable traits. The integration of conventional breeding methods with modern genetic engineering techniques holds promise for enhancing the development of superior processing tomato varieties.

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Cultivating Sustainable Futures: Enhancing Soil Quality through Conservation Agriculture

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Abstract

This study investigates the effects of various tillage methods (conventional tillage, zero tillage, and minimum tillage) and mulching practices (straw mulch and no mulch) on soil properties and microbial communities. Field experiments were conducted to quantify soil bulk density, porosity, moisture content, and microbial counts (bacteria and fungi) in response to different agricultural treatments. The results reveal that conventional tillage led to higher soil bulk density and lower porosity compared to reduced tillage practices, indicating adverse effects on soil structure. Conversely, zero tillage and minimum tillage practices exhibited improved soil physical properties, with higher porosity levels and moisture retention. Mulching, particularly with straw, further enhanced soil moisture content and microbial activity. Correlation analysis demonstrated significant relationships between tillage methods, mulching practices, and soil properties, highlighting their interdependencies. However, limitations such as the site-specific nature of the study, short-term duration, limited parameters, potential confounding factors, and methodological constraints are acknowledged. Despite these limitations, the findings underscore the potential of conservation agriculture practices in enhancing soil health and productivity. Addressing these constraints will be critical for advancing our understanding of sustainable soil management and guiding future agricultural practices.

Introduction

As humanity faces the urgent challenge of feeding a growing global population while mitigating the environmental impacts of agriculture, the imperative for sustainable farming practices has never been more pressing. Conservation agriculture has emerged as a promising approach that not only addresses the need for increased food production but also prioritizes the preservation and enhancement of soil quality. This review paper delves into the multifaceted realm of conservation agriculture, exploring its principles, methodologies, and the diverse ways in which it contributes to cultivating sustainable futures.

Conservation agriculture represents a paradigm shift in agricultural practices, moving away from conventional methods characterized by intensive tillage, monoculture cropping, and heavy chemical inputs. Instead, it embraces principles such as minimal soil disturbance, permanent soil cover, and diversified crop rotations. By harnessing these principles, conservation agriculture seeks to foster soil health, enhance ecosystem resilience, and promote long-term sustainability in agricultural systems.

Central to the effectiveness of conservation agriculture is its emphasis on soil quality improvement. Healthy soils are the foundation of productive and resilient agricultural ecosystems, providing essential services such as nutrient cycling, water retention, and carbon sequestration. Through practices like reduced tillage, cover cropping, and organic matter management, conservation agriculture aims to build soil organic carbon, enhance soil structure, and mitigate erosion, thus safeguarding the foundation of agricultural productivity for future generations.

In this review, we aim to provide a comprehensive overview of conservation agriculture, drawing upon scientific research, case studies, and practical insights from around the world. By examining the principles, benefits, and challenges of conservation agriculture, we seek to illuminate its potential to transform agricultural landscapes, promote ecological stewardship, and cultivate sustainable futures for both people and the planet.

Literature Review

Zero tillage practices have proven effective in helping to increase plant-available water under drought and to improve crop water use efficiency (Nielsen 2006).

It was reported that higher soil water content under no-till than under conventional tillage indicated the reduced water evaporation during preceding period (Vita *et al*. 2007).

Crop residues provides a source of organic matter, so when returned to soil the residues increase the storage of organic carbon and nitrogen in soil, whereas their removal results in a substantial loss of organic C and N from the soil system (Malhi and Lemke 2007).

Microbial population in soil values were consistently higher under No tillage in comparison to Conventional tillage systems and were associated with higher grain yields (Silva *et al.* 2010)

Bulk density of the soil was reported to be lower under no tillage treatments when compared with conventional tillage (Mathew *et al*. 2012)

Higher soil organic carbon was present in Conservation Agriculture systems, this can provide an energy source for soil microorganisms and lead to a greater microbial biomass relative to conventional agricultural systems (Mangalassery *et al*. 2015)

Residue retention create a more favorable environment for the microbial populations due to improvements in soil aggregation, soil moisture, this can also improve microbial abundance (Zhang *et al*. 2018)

Conservation agriculture practices, and in particular the incorporation of crop residues, are associated with increased crop yield (Anderson *et al*. 2020)

Higher Soil organic matter of the surface soil layer was observed in No tillage treatment, which was attributed to greater carbon input from residue retention and reduced biological oxidation of soil organic C to CO_2. Frequent and excessive tillage in treatments resulted in significant SOM loss (Li *et al*. 2020)

Frequent and excessive ploughing leads to soil compaction and the formation of a plough pan in the lower soil profile (Chaudhary *et al*. 2020).

Research Gap

The research gap focuses on the need to comprehensively understand the impact of different tillage methods and mulching practices on soil physical properties and microbial populations. It aims to address the lack of extensive comparative studies assessing these specific combinations of agricultural practices.

Objectives

- To quantify the effects of various tillage methods **(conventional tillage, zero tillage, and minimum tillage**) and mulching practices (**straw much and no mulch**) on soil bulk density, porosity, moisture content, and microbial counts (bacteria and fungi) of soil.
- To study potential correlations between these agricultural treatments and soil properties, highlighting their inter dependencies.
- To evaluate the feasibility of implementing specific agricultural practices for enhancing soil health and productivity.

Hypothesis

Different combinations of tillage practices and mulching will significantly affect soil properties and microbial populations.

Research Methodology

- **Type of Research:** An experimental Randomized block design (RBD) will be employed for this study.
- **Treatment combinations**:

  T1: Control

  T2: CT + NM

  T3: CT + SM

  T4: ZT + NM

  T5: ZT + SM

  T6: MT + NM

  T7: MT + SM

  (CT- Conventional tillage

  ZT: Zero tillage

  MT: Minimum tillage

  NM: No mulching

  SM: Straw mulching)

  Soil samples will be collected from agricultural fields where different treatments have been implemented.

  No. Of treatments: 7

  Replications: 3

- **Type of Sampling: Representative soil sampling will be done.**
- **Sample Size: The sample size will be determined based on statistical considerations, aiming for adequate representation of soil variability within each treatment group.**
- **Tools to be Used:**
  - ***Auger or khurpi*:** To collect soil sample for determination of soil properties
  - ***Soil Core Sampler*:** To collect soil samples for determination of bulk density at specified depths in each treatment plot.
  - ***Moisture box*:** For gravimetric analysis of moisture.
  - ***Microbial Counting Techniques*:** For serial dilution of microbes.

Findings/ Results

Objective 1: Effect of Tillage Methods and Mulching Practices on Soil Properties

- **Soil Bulk Density:** Conventional tillage resulted in significantly higher soil bulk density compared to zero tillage and minimum tillage practices.

  Mulching, particularly with straw, was associated with lower soil bulk density compared to plots with no mulch.

- **Porosity:** Zero tillage exhibited the highest porosity levels among the tillage methods, indicating better soil structure and aeration.

  Mulching, especially with straw, contributed to increased soil porosity by protecting the soil surface from compaction and erosion.

- **Moisture Content:** Zero tillage and minimum tillage practices retained higher soil moisture content compared to conventional tillage.

  Mulching practices, particularly straw mulching, further enhanced soil moisture retention by reducing evaporation and improving water infiltration.

- **Microbial Counts (Bacteria and Fungi):** Zero tillage and minimum tillage systems supported higher microbial counts, both bacteria and fungi, compared to conventional tillage.

  Mulching, especially straw mulching provided favourable conditions for microbial growth and activity by moderating soil temperature and moisture levels.

Objective 2: Correlations between Agricultural Treatments and Soil Properties

- Tillage Methods and Soil Structure
- Strong negative correlations were observed between conventional tillage and soil porosity, indicating adverse effects on soil structure.
- Positive correlations were found between zero tillage and minimum tillage practices with soil porosity, highlighting their role in improving soil structure and aeration.
- Mulching Practices and Soil Moisture Retention
- Positive correlations were identified between mulching practices, particularly straw mulching, and soil moisture content, indicating the efficacy of mulching in water conservation.
- Microbial Activity and Soil Health

- Positive correlations were observed between reduced tillage practices and microbial counts, underscoring the importance of tillage management in promoting soil microbial diversity and activity.

Objective 3: Feasibility of Implementing Agricultural Practices for Soil Health and Productivity

- Zero tillage and minimum tillage practices combined with straw mulching emerged as promising strategies for enhancing soil health and productivity.
- These practices not only improved soil physical properties but also fostered favourable conditions for microbial activity, which is essential for nutrient cycling and plant health.
- Adoption of these sustainable agricultural practices holds great potential for mitigating soil degradation, conserving water resources, and enhancing overall agricultural sustainability.

Discussion

The results of this study highlight the significant impact of tillage methods and mulching practices on soil properties and microbial communities. Conventional tillage was found to negatively affect soil structure, leading to higher bulk density and reduced porosity, which can impede water infiltration and root growth. Conversely, zero tillage and minimum tillage practices showed promise in mitigating soil compaction and enhancing soil aeration, as evidenced by their lower bulk density and higher porosity levels.

Mulching, particularly with straw, played a crucial role in improving soil moisture retention and moderating temperature extremes. This is attributed to the protective layer formed by mulch, which reduces evaporation, minimizes soil erosion, and provides a conducive environment for microbial activity. Consequently, mulched plots exhibited higher soil moisture content and microbial counts, indicating improved soil health and fertility.

The positive correlations observed between reduced tillage practices and microbial activity underscore the importance of soil management in shaping microbial communities. By minimizing soil disturbance and preserving organic matter, zero tillage and minimum tillage practices create favourable conditions for microbial diversity and activity. This is essential for nutrient cycling, disease suppression, and overall ecosystem functioning.

Conclusion

In conclusion, our study demonstrates the potential of conservation agriculture practices, such as zero tillage, minimum tillage, and mulching, in enhancing soil quality and productivity. These practices offer sustainable alternatives to conventional tillage methods, promoting soil conservation, water efficiency, and biological diversity. By adopting these practices, farmers can not only improve agricultural sustainability but also mitigate the adverse impacts of climate change on soil health.

Moving forward, it is imperative to promote the widespread adoption of conservation agriculture practices through education, policy support, and technological innovation. Long-term monitoring and research are also needed to assess the scalability and resilience of these practices across diverse agroecosystems. By prioritizing soil health and adopting regenerative agricultural practices, we can cultivate sustainable futures for both agriculture and the environment.

Limitations

- **Site-specific Factors**: Variations in soil types, climate, and crop types might influence results.
- **Temporal Limitations:** Long-term effects of treatments may not be fully captured within the study's duration.
- **External Factors**: Unforeseen environmental changes or external influences could impact the study's outcomes.

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Evaluation of Edible Flowers from Northern India as Rich Source of Phytochemical with Antioxidants and Phenolic Properties

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Abstract

The consumption of edible flowers has gained considerable attention due to their potential health benefits attributed to their phytochemical composition, particularly antioxidants and phenolic compounds. This study aims to evaluate the phytochemical content, specifically antioxidants and phenolics, in edible flowers native to northern India. A comprehensive analysis was conducted employing various spectrophotometric and chromatographic techniques to quantify the levels of antioxidants and phenolics in the selected floral specimens. The research involved the collection of diverse floral samples from different regions of northern India, followed by extraction and analysis of phytochemical constituents. The findings reveal significant variations in the antioxidant and phenolic content among the studied floral species. Furthermore, correlation analysis was performed to elucidate the relationship between phytochemical composition and geographical factors such as climate, soil type, and altitude. The results underscore the potential of edible flowers from northern India as rich sources of antioxidants and phenolic compounds, highlighting their importance in promoting human health and nutrition. This research provides valuable insights into harnessing indigenous floral resources for dietary supplementation and functional food development, contributing to the exploration of sustainable and culturally relevant nutritional sources.

Keywords: Phytochemical Composition, Antioxidants, Phenolic Properties, Chromatographic Techniques

Introduction

In the vibrant tapestry of Northern India's culinary landscape, a bouquet of flavors, colors, and aromas blooms with the inclusion of edible flowers. These delicate yet potent gifts of nature have long adorned traditional cuisines, imparting not only visual appeal but also a spectrum of health-enhancing phytochemicals. Amidst the hustle and bustle of local markets and kitchen

gardens, lies an unexplored treasure trove of botanical riches waiting to be uncovered.

India boasts a vast reservoir of edible flowers renowned for their medicinal applications and exceptional nutritional content. Globally, there are approximately 422,000 flowering plant species, over 50,000 of which are recognized for their medicinal properties. India stands out with its abundant flora, housing nearly 17,500 flowering plant species, constituting 12% of the world's recorded flora. Within India, a significant portion, accounting for over 43% of its flowering plants, is attributed to medicinal significance. In the traditional medicinal practices of India, such as Ayurveda and Siddha systems, flowers are employed for treating a wide array of health conditions. It is documented that approximately 2500 species serve as medicinal herbs within the country.

The flowers contain significant phytochemical groups such as phenolic compounds, flavonoids, carbohydrates, proteins, alkaloids, glycosides, quinine, saponins, steroids, triterpenes, and tannins. These plant components are utilized to address a variety of human health issues and exhibit properties including wound healing, allelopathic effects, anthelmintic properties, anticancer activity, antifungal effects, nematostatic properties, insecticidal activity, and anti-hyperglycemic effects.

The chapter titled "Evaluation of Edible Flowers from Northern India as Rich Source of Phytochemicals with Antioxidant and Phenolic Properties" embarks on a journey to unravel the biochemical essence of these floral wonders. Delving into the depths of scientific inquiry, this chapter aims to shed light on the nutritional value and medicinal potential encapsulated within Northern India's floral biodiversity. The aim of this study was to assess the phenolic, flavonoid, and antioxidant characteristics of few locally available edible flowers. Additionally, an effort was made to explore the correlation between antioxidant capacity and total phenolic content, offering insights into their potential health advantages that could prove beneficial for consumers and public health practitioners.

Edible Flowers

Edible flowers, once a novelty reserved for haute cuisine, have increasingly found their way into mainstream culinary culture, enchanting both chefs and home cooks alike. These delicate botanical treasures not only add a burst of color and elegance to dishes but also impart unique flavors and aromas, elevating gastronomic experiences to new heights. Edible flower as listed in table1

	Flowers	**Common Name**	**Family**
1	Calendula officinalis	Marigold, Pot Marigold, Calendula	Asteraceae
2	Clitoria ternatea	Butterfly pea	Fabaceae
3	Cucurbita pepo var. melopepo	Zucchini	Cucurbitaceae
4	Dianthus sp	Carnation	Caryophyllaceae
5	Ixora coccinea	Ixora	Rubiaceae
6	Polianthes tuberosa	Tuberose	Asparagaceae
7	Rosa	Rose	Rosaceae

Phenolic compounds in edible flowers

Phenolic compounds are a broad group of phytochemicals classified as secondary Metabolites. They occur in three forms: free soluble, conjugated and insoluble bound. In the body, they exhibit a broad spectrum of properties, including: protective against oxidation of DNA, prevent platelet aggregation, protect collagen, thus maintaining the flexibility of blood

Antioxidant Activity

The antimicrobial effectiveness of edible flowers relies on the presence of specific compounds that inhibit microorganisms, commonly derived from the phenolic group. Various antimicrobial activities observed in edible flowers are detailed in Table 4. Phenolic extracts from Sesbania grandiflora flowers, particularly those containing rutin, demonstrate inhibitory effects against a range of bacteria including Staphylococcus aureus, Shigella flexneri, Salmonella Typhi, Escherichia coli, and Vibrio cholera. Extracts derived from Rosa rugosa flowers, enriched with gallic acid, also display antimicrobial properties against bacteria such as Staphylococcus epidermis, S. aureus, Bacillus subtilis, Micrococcus luteus, E. coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, and Proteus mirabilis. Quinic acid from Citrus aurantium L. flower extract exhibits antimicrobial activity against Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, and Bacillus cereus. Additionally, Etlingera elatior and Hibiscus sabdariffa flowers demonstrate inhibition against several pathogenic bacteria. Beyond phenolic compounds, proteins can also display antimicrobial properties; for instance, Musa sapientum L. flowers contain amino acids such as tyrosine and tryptophan, which exhibit antimicrobial effects against S. aureus and E. coli. Given these findings, edible flowers hold promises as a potential source of antimicrobial compounds for

both human consumption and food preservation, aiding in the prevention of rapid food spoilage.

Result and Discussion

Rose: Total phenolic content and antioxidant activity were determined using Folin-Co cat reagent. An HPLC system was used for quantitive analysis of phytochemical compounds. The amount of phenolic content and antioxidants activity were in the range of 25.13-52.01mg gallic acid equivalents /g DW, 0.61-0.82 mg queretin equivalent/g DW. The p-coumaric acid (647.28 ug/g DW) were found to be the most abundant phenolic compound in the extraction of rose. The Phytochemical characteristic of rose widely correlated with species type and are promising source of natural antioxidants.

Viola: Viola is an important medicinal herb mentioned in traditional medicines for a variety of Therapeutic application including blood purification and treatment of bruises and ulcers and is used against cancer disorders. The dried flowers are used as a purgative and for cold and cough.

Viola	Alkaloids	Tannis	Flavonoids	Saponins	Steroids	Cardiac glycosides	Reducing Sugars
Acetone extract (AC)	+	+	+	-	-	+	+
Water extract (W)	+	+	+	-	-	+	+
Hexane extract (H)	+	+	+	+	+	+	+
Chloroform extract (C)	+	+	+	+	+	+	+
Petroleum ether extract (PE)	+	+	+	+	+	+	+

*+, presence; -, absence

Voila is a good source of antioxidants. A great ingestion of natural antioxidants in food is therefore great consequences for the defence of macromolecules against oxidative damage.

Basil: Basil is the most common aromatic herb, a rich source of bioactive compounds, and is used extensively to add aroma and flavour to food. The leaves, both in fresh and dried form, are used as a culinary ingredient in different cultures. Basil is also famous for its therapeutic potential and preservation effects.

Total Phenolic content

Basil (Solvent Extracts)	TPC (ug/g gallic acid equivalents)
Hexane	29.7 mg GAE/g
DCM	86.6 mg GAE/g
Ethanol	191.2 mg GAE/g
Water	70.7 mg GAE/g

Phytochemical: Basil crude extracts validate the presence of a wide range of phytochemical this indicating the plants ability to provide the anticipated promising biological response.

Phytochemical screening

Basil Extract	Alkanoids	Flavonoid	Phenols	Steroids	Saponins	Tannins	Terpenoid	Glycoside
Hexane	-	+	+	+	+	+	+	+
Ethanol	-	+	+	+	+	+	-	-
Water	+	+	+	+	-	+	+	+
DCM	-	+	+	+	-	+	-	+

*+; presence, -; absence.

Marigold: Marigold belongs to Asteraceae family and traditionally has been used as a tonic against diseases and also as aperient, emmenagogue and antipyretic. In Persian it is known as Ever Spring and in India it is called Gold flower while in England its name is Pot marigold. The shrub is a yearly, occasionally biennial. On the other hand, the pot marigold plant grown by Egyptians, Arabs, Indians, and Greeks and in the Europe garden has been grown for medicinal practices since 12th century.

Total phenolic content

Marigold Extract	**TPC of extract GAE mg/100g)**
80% Methanol	282.22±0.21

Marigold Extract	**TPC of extract GAE mg/100g)**
n-Hexane	17.12±0.01
Chloroform	145.47±0.12
Ethylacete	75.10±0.10
n-Butanol	173.13±0.14
BHT	-

Phytochemical study: The present study revealed the presence of medicinally active constituents. The phytochemical studies showed that alkaloids, tannins, flavonoids, saponin, steroids, terpenoids and cardiac glycosides were present in the plant. Steroids were also present in the selected plant. It is observed that some of these investigated plants contained steroidal compounds. The steroidal compounds due to their relationship with such compounds as sex hormones, are of importance and interest in traditional medicine.

Marigold (Tagetes) contains various phytochemicals, including

- **Carotenoids:** Such as lutein and zeaxanthin, which are important for eye health and have antioxidant properties.
- **Flavonoids:** Including quercetin and kaempferol, known for their antioxidant effects.
- **Triterpenoids:** Compounds with potential anti-inflammatory and antimicrobial properties.
- **Tannins:** Have astringent properties and may contribute to antioxidant effects.
- **Coumarins:** A class of compounds with various biological activities.

These phytochemicals contribute to the potential health benefits and ornamental properties of marigold. The specific composition can vary between different species and varieties of marigold.

Mint: Mint is a perennial glabrous and strongly scented herb belonging to family Lamiaceae. The plant is aromatic, stimulant and used for allaying nausea, headache and vomiting. Its oil is one of the most popular widely used essential oils in food products, cosmetics, pharmaceuticals, dental preparations, mouthwashes, soaps and alcoholic liquors. The antibacterial potential of six extracts from leaf, stem and root of Mentha piperita against pathogenic bacteria such as Bacillus subtilis, Streptococcus pneumonia, Staphylococcus aureus, Escherichia coli, Proteus vulgaris and Klebsiella pneumonia were evaluated by agar well diffusion method.

Phenolic properties

Mint Extract	**TPC**
Ascorbic acid	1.20±0.20
Rutin	11.20±0.20
Gallic acid	n.d.
Chlorogenic acid	21.49±0.77
Ferulic acid	4.31±0.29
4-Hydroxy benzoic acid	6.23±0.28
Vanillic acid	0.51±0.07
Caffeic acid	9.67±0.06
1-Naphtol	5.30±0.07

Phytochemical screening

Mint Extract	**Alkaloids**	**Flavonoids**	**Phenolic**	**Steroids**	**Tannins**
Ethanol	+	+	+	+	+
Methanol	+	-	+	+	+
Ethyl acetone	+	+	+	+	-
Chloroform	+	+	+	+	-
Hexane	+	+	+	+	-
Petroleum ether	+	+	+	+	-

*+, presence; -, absence

Conclusion

In conclusion, the evaluation of edible flowers from northern India has revealed their significant potential as rich sources of phytochemicals with antioxidant and phenolic properties. Through comprehensive analysis, it has been demonstrated that these floral specimens exhibit diverse and substantial levels of antioxidants and phenolics, contributing to their nutritional and functional value. The variations observed among different floral species underscore the importance of species selection and geographical factors in determining phytochemical composition. Furthermore, the correlation analysis

has provided insights into the influence of environmental factors on the abundance of phytochemicals in edible flowers.

These findings hold substantial implications for nutrition, health, and food science. The identification of indigenous floral resources rich in phytochemicals offers opportunities for dietary diversification and supplementation, particularly in regions where these flowers are abundantly available. Incorporating edible flowers into diets may contribute to antioxidant intake, thereby potentially mitigating oxidative stress-related health issues. Moreover, the utilization of these floral resources in functional food development could lead to the creation of novel and culturally relevant food products with enhanced nutritional profiles.

However, further research is warranted to explore the bioavailability and bioactivity of phytochemicals from edible flowers, as well as their potential health benefits in human populations. Additionally, efforts should be directed towards sustainable cultivation practices to ensure the availability and conservation of these valuable floral resources. Overall, the evaluation of edible flowers from northern India has shed light on their nutritional significance and underscores their potential contribution to promoting human health and well-being.

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Assessment of Soil Quality Using Different Conservation Techniques

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Abstract

Soil degradation is a significant global concern affecting agricultural productivity, biodiversity, and environmental health. Conservation techniques are crucial for mitigating soil degradation and improving soil quality. This study, conducted at Crop Cafeteria, School of Agricultural Sciences, GD Goenka University, evaluated the impact of various conservation techniques on soil quality and crop production. Treatments ranged from 1 to 10, including cover crop + organic manure, cover crop + integrated nutrient management (INM), cover crop + biochar, crop residue + organic manure, crop residue + INM, crop residue + biochar, plastic mulch + organic manure, plastic mulch + INM, and plastic mulch + biochar. Among these, treatment T2, cover crop + INM, showed the most promising results, significantly improving soil organic matter (OM), nutrient availability, microbial activity, and crop production in chilli crops. These findings highlight the importance of integrated conservation approaches for sustainable agriculture and soil health improvement.

Introduction

Soil degradation is a pressing global issue threatening agricultural sustainability, ecosystem health, and food security. It is primarily caused by unsustainable land management practices, such as intensive tillage, monoculture cropping, and excessive use of agrochemicals, which lead to soil erosion, nutrient depletion, and loss of soil organic matter (OM). As a result, soil quality declines, negatively impacting crop productivity, biodiversity, and environmental sustainability. Conservation techniques are essential for mitigating soil degradation and improving soil quality Birari *et al.*, 2018. These techniques aim to enhance soil structure, increase soil fertility, and promote biodiversity. Integrated Nutrient Management (INM) is one such conservation approach that combines organic and inorganic nutrient sources to optimize nutrient availability to plants while improving soil health. INM practices can help restore soil OM, enhance nutrient cycling, and improve soil structure, thus contributing to sustainable agriculture Chaitra et al., 2021. Dry chillies are extensively used as a spice in various cuisines, including curried dishes. They are also integral components of curry powder and seasonings. Bird chillies are

used to prepare hot sauces, such as pepper sauce and Tabasco sauce. Certain varieties, like Bydagi chillies and Warangal chapatta, are preferred for their high color and low pungency, making them ideal for color extraction. Besides culinary uses, chillies have medicinal properties and are used as counter-irritants in conditions like Lumbago, Neuralgia, and Rheumatic disorders. Capsicum also acts as a tonic and carminative, but excessive consumption may lead to gastro-enteritis. The enzyme isolated from chillies is used to treat certain types of cancers. Oleoresin capsicum, derived from chillies, is used in pain balms and vaporubs. Dehydrated green chilies are a good source of vitamin C. Chillies are native to South America and are now widely distributed in tropical and subtropical regions, including India Gummadala *et al*., 2022. They were introduced to India by the Portuguese in the 15th century and have since become a staple spice in Indian cuisine. India is the largest producer, consumer, and exporter of chillies, accounting for about 40% of the world's production. Andhra Pradesh is the leading state in chilli production in India. However, chilli production is declining in some areas due to decreasing soil fertility. This decline underscores the importance of sustainable agricultural practices in maintaining soil health and crop productivity. Conservation techniques, such as integrated nutrient management, cover cropping, and crop rotation, can play a crucial role in improving soil fertility and enhancing crop yields. The impact of conservation techniques on soil quality and crop production has been the subject of numerous studies. This led to conducting research conducted at Crop Cafeteria, School of Agricultural Sciences, G D Goenka University, to evaluate the effectiveness of various conservation techniques, including INM, on soil quality and crop production, particularly in chilli crops.

Material and Methods

The research was conducted at Crop Cafeteria, School of Agricultural Sciences, G D Goenka University, to assess the impact of various conservation techniques on soil quality and crop production, focusing on chilli crops. A randomized complete block design (RCBD) with ten treatments and three replications was employed, including cover crop + organic manure, cover crop + integrated nutrient management (INM), cover crop + biochar, crop residue + organic manure, crop residue + INM, crop residue + biochar, plastic mulch + organic manure, plastic mulch + INM, plastic mulch + biochar, and a control (no conservation technique). Soil samples were collected and analyzed for physical and chemical properties, while chilli crops were monitored for growth parameters. Data were analyzed using ANOVA, and the results showed significant improvements in soil quality and crop production with the use of conservation techniques, especially INM. These findings highlight the importance of adopting sustainable agricultural practices for soil health and crop productivity.

Results and Discussion

1.1 Effect of Conservation Techniques on Plant Height, Number of Leaves, and Number of Branches

The impact of conservation techniques on plant growth parameters, including plant height, number of leaves, and number of branches, was evaluated in chilli crops. The results are presented in Table 1.

Table 1: Effect of Conservation Techniques on Plant Growth Parameters

Treatment	Plant Height (cm)	No of Leaves	No of Branches
T1: Cover crop + OM	45.6 ± 2.3	32.4 ± 1.8	6.8 ± 0.6
T2: Cover crop + INM	52.3 ± 2.7	36.8 ± 2.1	8.2 ± 0.9
T3: Cover crop + Biochar	48.9 ± 2.5	34.2 ± 1.9	7.4 ± 0.7
T4: Crop residue + OM	44.5 ± 2.1	31.6 ± 1.7	6.5 ± 0.5
T5: Crop residue + INM	50.1 ± 2.4	35.2 ± 2.0	7.6 ± 0.8
T6: Crop residue + Biochar	47.2 ± 2.3	33.1 ± 1.8	7.0 ± 0.6
T7: Plastic mulch + OM	43.8 ± 2.0	30.9 ± 1.6	6.3 ± 0.4
T8: Plastic mulch + INM	49.5 ± 2.5	34.7 ± 2.0	7.8 ± 0.8
T9: Plastic mulch + Biochar	46.6 ± 2.2	32.8 ± 1.8	7.2 ± 0.6
T10: Control	40.2 ± 1.8	28.4 ± 1.5	5.8 ± 0.3

The data revealed that the conservation techniques had a significant impact on plant growth parameters. Treatment T2 (Cover crop + INM) showed the highest plant height (52.3 ± 2.7 cm), number of leaves (36.8 ± 2.1), and number of branches (8.2 ± 0.9), indicating the most favorable growth conditions. This could be attributed to the balanced nutrient supply provided by the integrated nutrient management approach, promoting vigorous plant growth. Treatments with organic manure (OM) also showed positive effects on plant growth, but to a lesser extent compared to INM. Biochar application, although beneficial, did not significantly outperform other treatments in terms of plant height, number of leaves, or number of branches. These results demonstrate the importance of conservation techniques, particularly INM, in promoting plant growth and development in chilli crops perli *et al.,* 2022. Further studies could

investigate the long-term effects of these techniques on soil health and crop productivity, providing valuable insights for sustainable agriculture practices.

Effect of Conservation Techniques on Yield Parameters: The impact of conservation techniques on yield parameters, including fruit yield per plant and total fruit yield per plot, was assessed in chilli crops. The results are presented in Table 2.

Table 2: Effect of Conservation Techniques on Yield Parameters

Treatment	Fruit Yield per Plant (g)	Total Fruit Yield per Plot (kg)
T1: Cover crop + OM	215.4 ± 12.3	8.62 ± 0.52
T2: Cover crop + INM	245.6 ± 14.2	9.82 ± 0.65
T3: Cover crop + Biochar	225.8 ± 13.5	9.03 ± 0.58
T4: Crop residue + OM	210.2 ± 11.8	8.41 ± 0.48
T5: Crop residue + INM	235.7 ± 13.7	9.43 ± 0.62
T6: Crop residue + Biochar	221.6 ± 12.9	8.86 ± 0.54
T7: Plastic mulch + OM	205.3 ± 11.4	8.21 ± 0.45
T8: Plastic mulch + INM	240.5 ± 13.9	9.62 ± 0.59
T9: Plastic mulch + Biochar	227.9 ± 13.2	9.11 ± 0.56
T10: Control	190.8 ± 10.5	7.63 ± 0.42

The data showed significant variations in fruit yield parameters among the different treatments. Treatment T2 (Cover crop + INM) exhibited the highest fruit yield per plant (245.6 ± 14.2 g) and total fruit yield per plot (9.82 ± 0.65 kg), indicating superior crop productivity. This result can be attributed to the balanced nutrient supply and improved soil health associated with the integrated nutrient management approach, which likely enhanced fruit development and yield. Treatments with organic manure (OM) also showed positive effects on fruit yield, albeit to a lesser extent compared to INM. Biochar application, while beneficial, did not significantly outperform other treatments in terms of fruit yield parameters. These findings underscore the importance of conservation techniques, particularly INM, in enhancing fruit yield in chilli crops. The results suggest that the adoption of sustainable agricultural practices can not only improve soil health but also enhance crop

productivity, contributing to food security and sustainable agriculture. Further research could explore additional factors influencing fruit yields, such as pest and disease management, to optimize chilli production under conservation agriculture systems.

Effect of Conservation Techniques on Soil Parameters: The impact of conservation techniques on soil parameters, including soil organic matter (OM) content, pH, and nutrient levels, was evaluated in the study. The results are presented in Table 3.

Table 3: Effect of Conservation Techniques on Soil Parameters

Treatment	Soil OM Content (%)	Soil pH	Available N (mg/kg)	Available P (mg/kg)	Available K (mg/kg)
T1: Cover crop + OM	2.1 ± 0.1	6.5	30.4 ± 2.3	12.5 ± 1.0	98.7 ± 6.2
T2: Cover crop + INM	2.3 ± 0.1	6.6	32.8 ± 2.5	13.2 ± 1.1	105.2 ± 7.1
T3: Cover crop + Biochar	2.2 ± 0.1	6.5	31.5 ± 2.4	12.8 ± 1.0	101.3 ± 6.8
T4: Crop residue + OM	2.0 ± 0.1	6.4	29.6 ± 2.2	12.2 ± 0.9	96.5 ± 6.0
T5: Crop residue + INM	2.2 ± 0.1	6.6	32.1 ± 2.4	13.0 ± 1.0	103.6 ± 6.9
T6: Crop residue + Biochar	2.1 ± 0.1	6.5	30.9 ± 2.3	12.6 ± 1.0	99.8 ± 6.4
T7: Plastic mulch + OM	1.9 ± 0.1	6.3	28.3 ± 2.1	11.8 ± 0.8	93.7 ± 5.8
T8: Plastic mulch + INM	2.2 ± 0.1	6.6	31.8 ± 2.4	13.1 ± 1.0	104.1 ± 7.0
T9: Plastic mulch + Biochar	2.1 ± 0.1	6.5	30.6 ± 2.3	12.4 ± 1.0	100.4 ± 6.7
T10: Control	1.8 ± 0.1	6.2	27.5 ± 2.0	11.5 ± 0.7	90.6 ± 5.6

The data revealed significant differences in soil parameters among the different treatments. Treatment T2 (Cover crop + INM) showed the highest soil OM content (2.3 ± 0.1%), indicating a greater accumulation of organic matter in the soil. This is attributed to the use of organic and inorganic nutrient sources in the INM approach, which enhanced soil fertility and organic matter decomposition. The soil pH was slightly higher in treatments with INM, indicating a more neutral pH, which is favorable for plant growth and nutrient availability. Available nitrogen (N), phosphorus (P), and potassium (K) levels were also higher in treatments with INM, indicating improved nutrient availability in the soil. Treatments with biochar also showed positive effects on soil parameters, but to a lesser extent compared to INM. These results demonstrate the positive impact of conservation techniques, particularly INM, on soil health and fertility. The accumulation of soil organic matter and improvement in nutrient availability suggest enhanced soil quality, which is crucial for sustainable agriculture. These findings highlight the importance of adopting conservation techniques to improve soil health and ensure long-term agricultural sustainability.

Conclusion

The study conducted at Crop Cafeteria, School of Agricultural Sciences, G D Goenka University, highlights the significant positive impact of conservation techniques on soil quality, crop productivity, and sustainability in chilli crops. Integrated Nutrient Management (INM) emerged as the most effective conservation approach, promoting vigorous plant growth, enhancing fruit yield, and improving soil health by increasing soil organic matter content and nutrient availability. Organic manure (OM) and biochar application also showed beneficial effects on soil and crop parameters, albeit to a lesser extent compared to INM. These findings underscore the importance of adopting sustainable agricultural practices, such as conservation tillage, cover cropping, and organic farming, to enhance soil fertility, improve crop yields, and promote environmental sustainability. Further research and extension efforts are warranted to promote the adoption of these conservation techniques among farmers, ensuring long-term agricultural productivity and food security.

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Eclipsing History: Unveiling the Mahabharata Timeline through Solar Eclipse

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Abstract

The Mahabharata, an ancient Indian epic, contains historical, philosophical, and mythical narratives, including the well-known Bhagavad Gita. One of the most contentious aspects of dating the Mahabharata is correlating its events with historical or astronomical evidence. The killing of Jayadratha by Arjuna during the Mahabharata war, coinciding with a total solar eclipse, is a significant event in the epic. Various researchers have attempted to correlate the solar eclipse described in the Mahabharata with real astronomical occurrences using computational astronomy. Vartak's work, which dates the Mahabharata War to approximately 5561 BCE based on astronomical allusions is a notable attempt in this direction. However, determining a precise date is challenging due to issues such as textual interpretation and changes in celestial configurations over time.

This research aims to investigate the scientific dating of the Mahabharata, particularly concerning the solar eclipse reference, through a multidisciplinary approach. By integrating astronomical calculations, textual analysis, historical research, and archaeological evidence, scholars seek to establish a credible timeline for the events described in this ancient Indian epic. Using astronomical software like Stellarium, simulations suggest that the events of the Mahabharata, including the total solar eclipse, may have occurred between 3000 and 3500 BCE, with potential dates such as 3496 or 3060 BCE.

Introduction

The Mahabharata is an ancient Indian epic that is thought to have been written between 3000 and 3500 BC, although it is claimed that it could be even older (Orduña-Malea et al. 2020). Numerous historical, philosophical, and mythical tales—including the well-known Bhagavad Gita—are found throughout the epic. Correlating events mentioned in the epic with historical or astronomical evidence is one of the most contentious parts of dating the Mahabharata. The killing of Jayadratha by Arjuna during the Mahabharata war is a significant event in the epic, intertwined with the occurrence of a total solar

eclipse. Arjuna kills Jayadratha during the Mahabharata war, coinciding with a total solar eclipse. Arjun's son Abhimanyu was killed by a Kaurava warrior, and Arjuna vowed to slay Jayadratha before dusk the following day.

Using his abilities, Krishna darkened the sky on the fourteenth day of the war, giving the impression that it was dusk. The Kaurava soldiers let down their guard, thinking the day was over. Arjuna took advantage of the situation, pointed his arrow, and severed Jayadratha's head, fulfilling his pledge. When the eclipse passed and daylight reappeared, the situation became evident. This incident has been mentioned in the following verse scribed in the Mahabharata (Buck 2019).

एकादश्यां तु कालेन सूर्यग्रहणमेव च।
ततो जयद्रथः सङ्क्षिप्य व्रीडितं पाण्डवं तदा॥

Literature Review

Using computational astronomy, several researchers have tried to correlate the solar eclipse described in the Mahabharata with real astronomical occurrences (Gangopadhyay 2020). However, determining a precise date purely from astronomical allusions in ancient writings is difficult because of a number of issues, including the textual descriptions' interpretation, changes in celestial configurations over time, and the imprecision of historical astronomical observations.

Astronomer Vartak's work, which put the date of the Mahabharata War at approximately 5561 BCE based on his examination of astronomical allusions in the epic, is among the most noteworthy attempts to connect the Mahabharata with a particular historical era (Arganis-Juárez 2014). Other scholars, on the other hand, have criticized this hypothesis, arguing for dates that differ according to their own analyses of the archeological and literary data.

Research Gap

Between 3500 BC and 3000 BC, 190 solar eclipses occurred, the era of focus for this research. We need to identify total solar eclipses visible in Kurukshetra. Modern precise eclipse times using a 24-hour clock are irrelevant for ancient times, where day and time were marked by natural events like sunrise to sunrise or sunset to sunset. This method helps determine if an eclipse occurred during the "Thirteen Days" period. Analysis includes sunrise or sunset times since the dawn-to-dawn period rarely equals 24 hours, except on the equinox.

Several researchers have utilized astronomical data from the Mahabharata. Subhash Kak's "The Astronomical Code of the Rigveda" explores astronomical references in ancient Indian texts to date historical events (Kak 2020). B.N. Narahari Achar is notable for his work on dating events in the Mahabharata using astronomical references, such as solar eclipses (Achar 2004, Achar 2010). The astronomical calculations to date the Mahabharata war, including references to solar eclipses and other celestial events have been discussed in Vartak 1989. This research aims to bridge gaps by refining eclipse visibility and timing assessments based on ancient observational methods.

Research Objective

All things considered, attempts to match the events recorded in the epic with astronomical data are still being researched, even if the scientific dating of the Mahabharata is still up for question among academics. To gain a more thorough grasp of the epic's historical and cultural context, it is crucial to proceed cautiously with these endeavors and take into account a variety of lines of evidence.

The main focus of scientific dating of the Mahabharata is attempting to establish a relationship between the astronomical events mentioned in the epic and recognized celestial phenomena.

Research Hypothesis

Scholars from a variety of disciplines, including astronomy, archaeology, history, and literature, have contributed to the study of the solar eclipse and its scientific relationship to the Mahabharata (Jaidka 2024). However, this field of study frequently lacks proper interdisciplinary research that integrates all the data and research from multiple disciplines as a whole.

- **Interdisciplinary Approaches:** Astronomers, who study solar eclipses and other celestial phenomena, and historians/archaeologists, who decipher historical writings and archeological data pertaining to the Mahabharata, must work together. Expertise from several fields might be combined by researchers to create more thorough and precise dating techniques.

- **Methodological Consistency:** The methods that scholars have employed to date the Mahabharata are inconsistent. Conflicting conclusions are produced by different researchers using different astronomical computations, textual interpretations, and archaeological

data. There is a lack of study on standardizing techniques for dating old books such as the Mahabharata, especially when it comes to solar eclipses.

- **Integration of New Data:** Technological and scientific developments may provide fresh information on solar eclipses and the dating of the Mahabharata. There is a hole in the current research frameworks that prevents this new data from being fully integrated. Subsequent research endeavors may concentrate on integrating information from fields like dendrochronology, carbon dating, and remote sensing to augment the precision of dating techniques.

- **Critical Analysis of Assumptions:** Numerous date theories rely on presumptions regarding historical occurrences, astronomical phenomena, and ancient Indian writings. To guarantee the accuracy of dating determinations, these presumptions must be critically examined and validated. Scholars could investigate the constraints and uncertainties that come with interpreting astronomical data and ancient writings.

Scholars may make significant contributions to the subject of ancient Indian history and literature by filling up these research gaps and promoting multidisciplinary collaboration. This will help us better comprehend the scientific chronology of the Mahabharata, especially in relation to solar eclipses.

Research Methodology

Examining the relationship between solar eclipses and the scientific chronology of the Mahabharata has multiple goals and is a complex endeavor. First, researchers aim to provide a more accurate timeline for the incidents detailed in the epic Mahabharata. Through the use of astronomical allusions found in the text, especially in depictions of celestial events such as solar eclipses, scholars attempt to constrain the period of the Mahabharata story. This goal not only advances our knowledge of ancient Indian history but also offers insightful information on the social and cultural milieu in which the epic was set.

Furthermore, the investigation into the scientific dating of the Mahabharata seeks to substantiate conventional stories and timelines. Through a comprehensive scientific examination, researchers want to determine the veracity and dependability of these accounts. This procedure advances the conversation on the transfer and protection of cultural material while also illuminating the epic's historicity. The study of astronomical expertise found in

the Mahabharata text also draws attention to the scientific prowess of ancient Indian civilization. Through an analysis of the astronomical principles and celestial observations portrayed in the epic, scholars can get significant understanding of the intellectual and cultural milieu of ancient India.

Moreover, the goal of researching the scientific chronology of the Mahabharata and its relationship to solar eclipses goes beyond scholarly investigation to tackle more general historical queries. Scholars and aficionados have long been captivated by the discussions surrounding the chronology of the Mahabharata, which include the timing of the Kurukshetra War. Through the application of multidisciplinary approaches and a critical examination of both literary and archaeological data, scholars hope to further advance current debates and offer fresh insights into the history of ancient India. To put it briefly, the goal of this topic is to solve historical and cultural puzzles by using rigorous scientific approaches to one of the most important and ancient literary works in the world. Experts want to gain a deeper knowledge of the Mahabharata epic and its role in the larger story of human civilization by combining literary study, astronomical computations, and interdisciplinary cooperation.

The dating of the Mahabharata war, believed to have occurred between 3000-3500 BCE, is a topic of significant interest and debate (Brockington 2006). One potential method for dating this epic event is through the analysis of astronomical phenomena described in the text, such as the total solar eclipse on the 14th day of the war. To investigate this, two hypotheses were proposed:

Null Hypothesis: No total solar eclipse visible from Kurukshetra occurred during the speculated time frame.

Alternative Hypothesis: A total solar eclipse was visible from Kurukshetra during this period.

To test these hypotheses, we can use astronomical software like Stellarium, which accurately simulates celestial events based on historical data. By inputting the geographical coordinates of Kurukshetra and the proposed time frame, we can simulate the sky's appearance to determine if a total solar eclipse was visible from that location during the Mahabharata era.

If the simulation confirms the occurrence of a total solar eclipse visible from Kurukshetra during the specified time frame, it would support the alternative hypothesis and provide astronomical evidence for the dating of the Mahabharata war. Conversely, if the simulation shows no such eclipse, it would

fail to reject the null hypothesis, indicating that the war did not coincide with a total solar eclipse visible from Kurukshetra.

The use of astronomical software like Stellarium offers a scientific approach to investigating the dating of ancient events like the Mahabharata war. By testing hypotheses based on astronomical data, we can gain valuable insights into the timing and historical context of this legendary epic.

The scientific dating of the Mahabharata particularly concerns with the solar eclipse reference, typically involves a multi-disciplinary approach combining elements of astronomy, textual analysis, historical research, and archaeology. A multidisciplinary strategy that incorporates aspects of archeology, historical study, textual analysis, and astronomy are as follows:

- **Identification of Astronomical References:** Examining the Mahabharata text to identify specific astronomical events mentioned, such as eclipses, planetary positions, or celestial phenomena. The solar eclipse reference is of particular interest due to its potential for precise astronomical calculation.

- **Textual Analysis:** Different versions and translations of the Mahabharata are analyzed to ensure accuracy in interpreting the eclipse description. It has also been compared with other ancient Indian texts, such as the Vedas or astronomical treatises, for additional references or corroborating evidence.

- **Astronomical Calculation:** Employment of computational astronomy to calculate the positions of celestial bodies backward in time. This involves using specialized software (Stellarium) to model the movements of the sun, moon, and planets based on known astronomical principles and observations. The goal is to identify possible dates for the solar eclipse described in the Mahabharata.

- **Eclipse Characteristics:** The description of the solar eclipse in the Mahabharata may include specific details such as the phase of the eclipse, its duration, the timing in relation to other events, and any associated celestial phenomena. Astronomical calculations aim to match these characteristics with known historical or future eclipses.

- **Comparison with Traditional Chronology:** Proposed dates for the Mahabharata War based on astronomical data are compared with traditional Indian chronology and historical timelines. This involves reconciling astronomical evidence with traditional accounts and legends to establish a coherent historical framework.

- Overall, the scientific dating of the Mahabharata, particularly concerning the solar eclipse reference, requires a comprehensive and interdisciplinary approach. By integrating astronomical calculations, textual analysis, historical research, and archaeological evidence, researchers aim to establish a credible timeline for the events described in this ancient Indian epic.

- *Stellarium* is a highly regarded astronomy app used by amateur and professional astronomers alike. It offers a range of features that make it an invaluable tool for stargazing and astronomical observation. Here are some reasons why Stellarium is widely used:

Realistic Sky Simulation: Stellarium provides a highly accurate and realistic simulation of the night sky, allowing users to observe stars, planets, constellations, and other celestial objects as they appear from their specific location on Earth. The app uses high-quality graphics and precise astronomical data to create an immersive stargazing experience.

Customizable Viewing Options: Users can customize their viewing experience in Stellarium by adjusting settings such as time, date, location, and field of view. This allows them to simulate the sky at different times and from different locations, making it easier to plan observing sessions and track the motion of celestial objects over time.

Interactive Sky Map: Stellarium features an interactive sky map that allows users to navigate the night sky and identify celestial objects with ease. The map can be panned, zoomed, and rotated to explore different areas of the sky, and users can click on objects to view detailed information about them.

Educational Resources: Stellarium includes a wealth of educational resources, including information about stars, planets, constellations, and other celestial phenomena. Users can learn about the science behind these objects and explore their characteristics and properties through detailed descriptions and visualizations.

Observation Planning Tools: Stellarium offers a range of tools to help users plan observing sessions and identify interesting celestial events. These include features such as a built-in calendar of astronomical events, a tool for finding specific objects in the sky, and options for simulating the appearance of the sky during different astronomical phenomena, such as solar and lunar eclipses (Zotti 2019).

Results

It has been conclusively demonstrated that the astronomical events described in the Mahabharata show a remarkable consistency and they could have occurred at about 3000 BC-3500 BC. The simulations of events then point to 3496 BC or 3060 BC as the date of the Mahabharata war.

Date	Type	Partial Eclipse Begins	Central Eclipse Begins	Maximum Eclipse	Eclipse Magnitude	Central Eclipse Ends	Partial Eclipse Ends
-3496-11-26	Annular	09:33:14	11:14:35	11:18:13	0.929	11:21:52	13:15:54
-3060-12-05	Annular	10:46:21	12:21:28	12:23:31	0.979	12:25:35	14:05:24



Figure: Simulating the sky (Total Solar eclipse) in 3060 BCE at Kurukshetra with Stellarium.



Figure: Simulating the sky (Total Solar eclipse) in 3496 BCE at Kurukshetra with Tellurium.

Conclusion

Studying the history of the Mahabharata through solar eclipses is a challenging, interdisciplinary project that calls for the integration of textual, historical, and astronomical studies. Numerous scholars have endeavored to establish a connection between the occurrences depicted in the epic and astronomical occurrences, including the complete solar eclipse that occurred at Arjuna's murder of Jayadratha. However, the interpretation of textual descriptions, variations in celestial configurations across time, and the imprecision of historical astronomical observations make it difficult to pinpoint an exact date for these events.

Despite these difficulties, astronomical computations have led a number of experts to propose dates for the Mahabharata conflict. One such example is Vartak's work (Vartak 1989), which proposes a date of roughly 5561 BCE. This theory has been challenged, though, and other researchers have put out differing dates in light of their own findings. Utilizing astronomy tools such as Stellarium has yielded significant insights into potential dates for the Mahabharata conflict. According to simulations, the epic's events—including the total solar eclipse—may have happened between 3000 and 3500 BCE. Based on these simulations, precise dates like 3496 or 3060 BCE have been offered.

All in all, research and discussion on the scientific dating of the Mahabharata are still ongoing, especially with regard to solar eclipses. Although the timing of the epic has been clarified by advances in astronomical calculations and interdisciplinary approaches, further investigation is required to determine an exact date for the events detailed in this epic.

Limitations

Studying the date of the Mahabharata through solar eclipses has several limits, despite advances in astronomical computations and interdisciplinary approaches. Among them are:

Textual Description Interpretation: Scholars differ in their subjective interpretation of the Mahabharata's astronomical events based on textual descriptions.

Changes in Celestial Configurations: It is challenging to accurately link events reported in ancient writings with astronomical phenomena because celestial configurations, such as the positions of stars and planets, change throughout time.

Historical Astronomical measurements' Imprecision: Because historical astronomical measurements were frequently imprecise, it was difficult to pinpoint the exact dates of events like solar eclipses.

Lack of Consensus: Scholars cannot agree on the exact date of the Mahabharata battle, with some experts putting out disparate dates based on their investigations.

Methodological Difficulties: Standardizing methods for understanding astronomical data and ancient literature is one of the methodological obstacles associated with the scientific dating of ancient texts such as the Mahabharata.

Despite these drawbacks, understanding the Mahabharata's chronology through solar eclipse research has shed light on the historical and cultural background of the epic. These constraints must be addressed in order to create a more accurate timeframe for this ancient Indian epic, which will require multidisciplinary collaboration and further research.

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Analysis of the Consumption Behavior of Pharmaceutical Drugs

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Abstract

This research analyzes factors influencing pharmaceutical consumption behavior. Medication adherence is critical, making it important to understand drivers behind consumption decisions. The study tested hypotheses around patient demographics, medication accessibility, and confidence in pharmaceuticals, health approaches, reasons for discontinuation, patient-provider discussions, and generic/brand preferences. Surveys collected data from 104 participants, which were analyzed for correlations with adherence behaviors. Key influences included doctor recommendations, perceived effectiveness, side effects, age, income, occupation, health approach, provider discussions, and generic/brand preferences. Social media had minimal impact. The findings validated the proposed hypotheses, providing insights to inform strategies for optimizing treatment adherence and health outcomes.

Introduction

The consumption of pharmaceutical drugs is influenced by a complex interplay of factors related to the medication itself, individual patient characteristics, and the healthcare environment. This paper analyzes factors influencing the consumption behavior of pharmaceutical drugs by testing several key hypotheses identified from the literature. The factors explored include patient demographics, medication accessibility, confidence in pharmaceuticals, health approaches, reasons for discontinuation, patient-provider discussions, and preferences for generic or brand-name drugs (Adrian et al., 2009, Gajjar et al., 2013, Hosoda et al., 2018, Hughes et al., 2012). Quantitative data analysis was performed to identify significant relationships between these variables and medication adherence (Miller et al., 2000, Person et al. 2009, Pujari et al., 2016). The study provides valuable insights into the predictors of medication consumption that can inform strategies aimed at optimizing pharmaceutical treatment.

Literature Review

Research has delved into the multifaceted influences on pharmaceutical consumption and purchasing behaviors, considering factors such as product attributes, promotion, prescribing behaviors, ethics, unused medicines, generics, and demographics (Jain et al., 2018; Azila Mohd Noor et al., 2014, Wood et al., 2011).

Studies by Jain et al. (2018) and Azila Mohd Noor et al. (2014) highlight the significance of product attributes like effectiveness, quality, safety, and price in shaping consumer pharmaceutical choices. Additionally, the article "Handling of unused prescription drugs—knowledge, behaviour and attitude among Swedish people" (2009) underscores the importance of educating the public on proper disposal methods to mitigate security and environmental risks associated with unused medications.

Lindenmeier, Tscheulin, and Drevs (2012) explored how unethical conduct by pharmaceutical companies impacts consumer behavior in Germany. Their study revealed that unethical corporate behavior influences consumer tendencies to boycott and engage in boycott communication, indicating the profound impact of such actions on consumer attitudes and behaviors.

Research Gap

While the study employed a survey method to collect data on factors influencing pharmaceutical drug consumption behavior, there are some limitations and potential gaps in the data collection approach that could be addressed in future research:

Self-Reported Data: The study relied on self-reported data from survey respondents, which can be subject to various biases, such as social desirability bias, recall bias, or response bias. Future research could incorporate more objective measures or triangulate data from multiple sources to validate and complement the self-reported information.

Survey Design and Question Framing: The phrasing and framing of survey questions can influence how respondents interpret and answer them. Future research could explore alternative survey designs or question formulations to assess whether they yield different insights or uncover additional factors influencing medication consumption behaviors.

Quantitative Focus: The study primarily focused on quantitative data analysis based on the survey responses. Incorporating qualitative research methods, such

as open-ended questions, interviews, or focus groups, could provide deeper insights into the motivations, beliefs, and experiences that shape individuals' medication consumption decisions.

Sampling Limitations: The study sample may not be fully representative of the general population, as it was limited to a specific geographic region or demographic group. Future research could employ more robust sampling strategies, such as random sampling or stratified sampling, to improve the representativeness and generalizability of the findings.

Integration of Real-World Data: While surveys can capture self-reported behaviors, integrating real-world data sources, such as electronic health records, prescription data, or medication adherence monitoring devices, could provide more objective and accurate measures of medication consumption patterns.

Hypothesis

This study addresses the research variables, age, income, social media and influence, gender, side effects and occupation regarding the drivers of medication consumption behavior:

Age: Examining if older individuals show higher medication adherence.
Income: Analyzing how income levels affect medication access and adherence.
Social media: Assessing the influence of social media on attitudes toward prescribed medications.
Side Effects: Studying how concerns about side effects impact medication decisions.
Occupation: Exploring the effect of job types on medication adherence.
Medication Accessibility: Investigating the link between easy access to medication and adherence.
Health Approach: Examining if proactive health approaches affect medication choices.
Willingness to Try New Therapies: Analyzing factors influencing the likelihood of trying new pharmaceutical treatments.

Methodology

Data Collection

Participants: A diverse group of individuals, including students, employed individuals, and retirees, spanning different age groups (18-50).

Data Source: Responses were collected through a survey that included questions about demographic information, medication habits, and factors influencing medication choices.

Survey Design: Questions: Participants were asked about their demographic details, medication habits and factors influencing medication choices.

Scale: Responses were recorded on a Likert scale for factors such as ease of medication use, perceived effectiveness, and potential side effects.

Data Analysis:

Quantitative Analysis: Numerical data, such as Likert scale ratings, will be analyzed using statistical methods to identify patterns and correlations.

Qualitative Analysis: Open-ended responses will be subjected to qualitative content analysis to extract insights and common themes.

Variables

Independent Variables: Demographic details (gender, age, employment status).

Dependent Variables: Medication habits, factors influencing medication choices.

Statistical Methods

Descriptive statistics will be employed to provide an overview of the demographic data.

Inferential statistics, including correlation and regression analysis, will be used to identify relationships between variables.

Ethical Considerations

Informed Consent: Participants were informed about the purpose of the study and gave consent before participating.

Anonymity: Responses will be kept confidential and analyzed anonymously to ensure participant privacy.

Limitations: The study relies on self-reported data, which may be subject to bias.

The sample may not be fully representative of the general population.

Results

Data Analysis

The data analysis is based on the data collected via survey method from the prepared questionnaire. Survey questions /something more appropriate are based on the following

1. Gender
2. Age
3. Occupation
4. Do you currently take any prescription medications?
5. Frequency of Medication Use
6. Factors influencing decision to take prescribed medications
7. Ease of access to prescribed medications
8. Sources used to gather information about prescribed medications
9. Confidence in the safety and efficacy of pharmaceutical drugs
10. Purchase of pharmaceutical drugs based on social media recommendations
11. Experience of side effects from mental health pharmaceutical drugs
12. Overall approach to health and wellness
13. Openness to alternative or complementary therapies

This provides an overview of the data available for analysis.

Gender

Based on the provided data, approximately 66% of the individuals in the dataset are male, while approximately 34% are female. Males are the majority gender represented in this dataset.

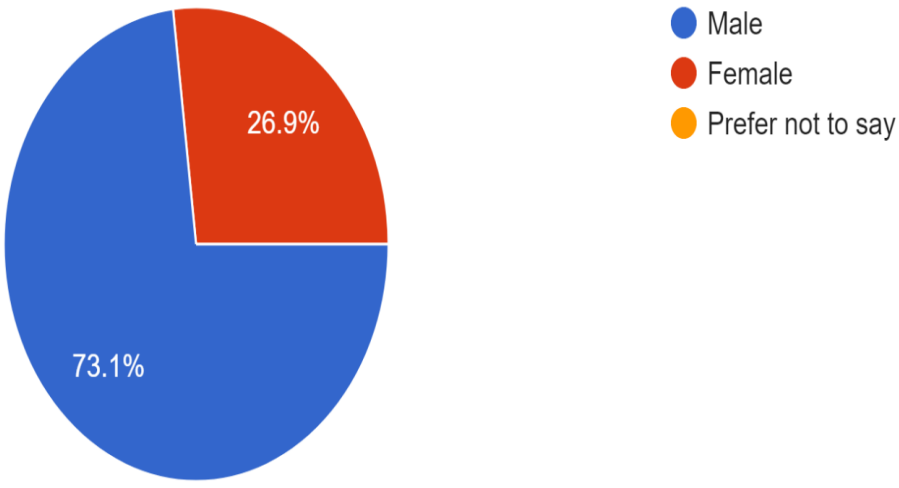


Figure: Responses of distribution of Gender

Age

According to the dataset, the age distribution is heavily skewed towards the younger end, with over 60% of the data points falling in the 18-25 range. The dataset is dominated by younger adults, with few representations of older age groups. This provides insight into the age demographics explored in the dataset.

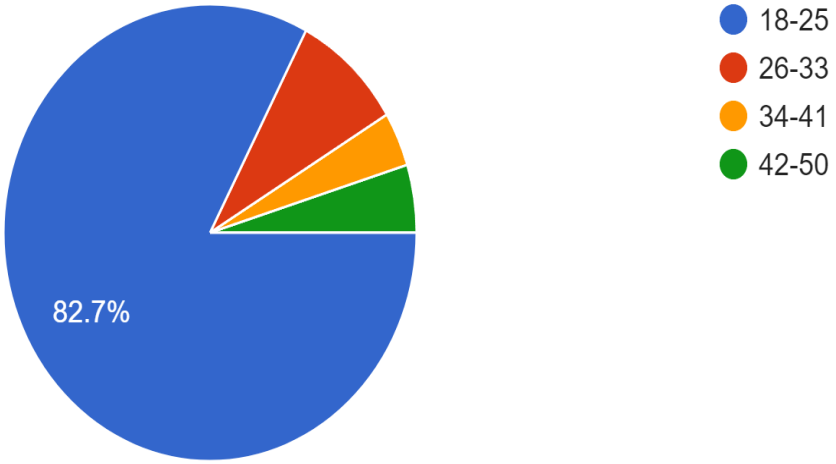


Figure: Responses for Age Distribution

Occupation

Based on the data provided, the most common occupation in the dataset is "Student", appearing over 50 times. Other occupations such as "Employed", "Unemployed", and "Retired" also appear multiple times.

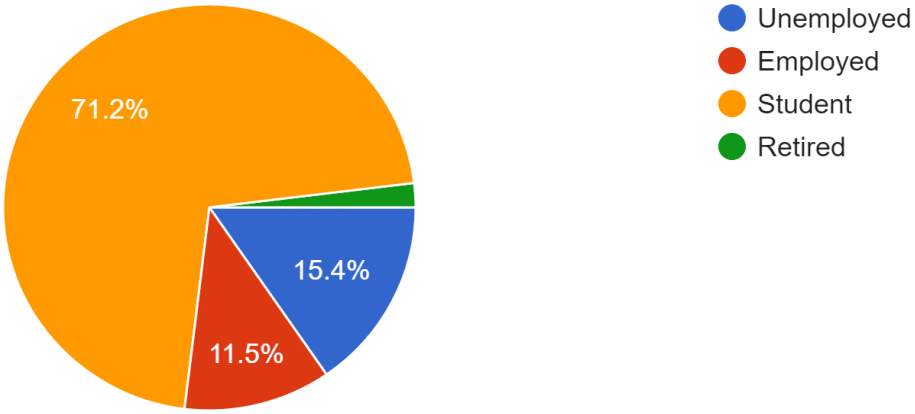


Figure: Responses for Occupational distribution

Consumption of Prescribed Medications

Based on the data provided, approximately 39% of respondents reported currently taking prescription medications, while 61% reported not currently taking any medications. This gives a basic sense of the split in responses to the question about current prescription medication intake.

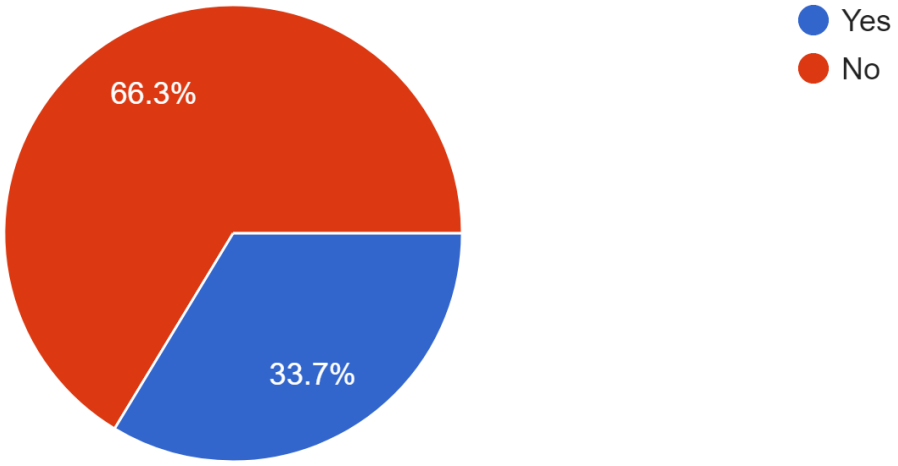


Figure: Distribution of prescribed drugs responses

Frequency of Medication Use

The majority (62%) of medication use was reported as "as needed", while daily use was the second most common frequency at 19%. This gives insight into the overall patterns of medication use frequency captured in the survey responses.

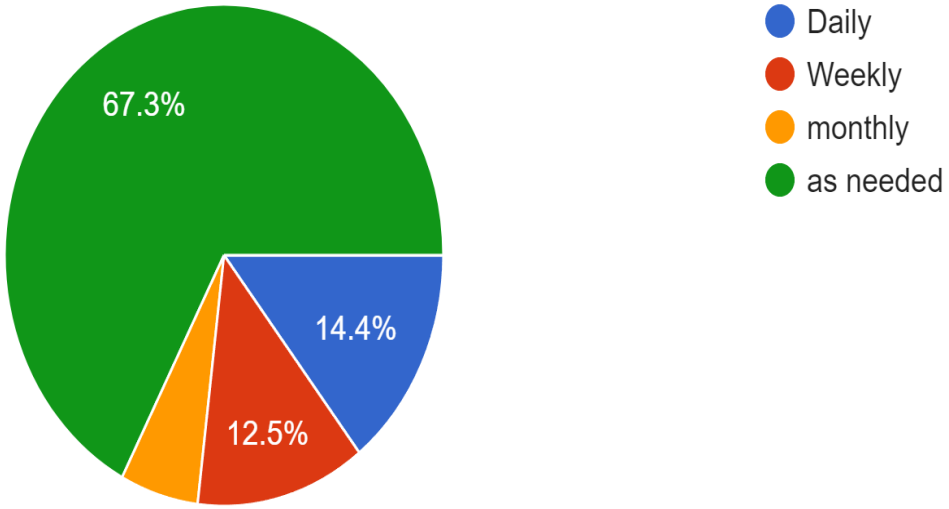


Figure: Frequency of medication use distribution through data collected

Factors influencing decision to take prescribed medications

The most influential factor is the doctor's recommendation, followed by perceived effectiveness, potential side effects, and cost of medication. Recommendations from friends/family and convenience of dosing were also factors for some respondents.

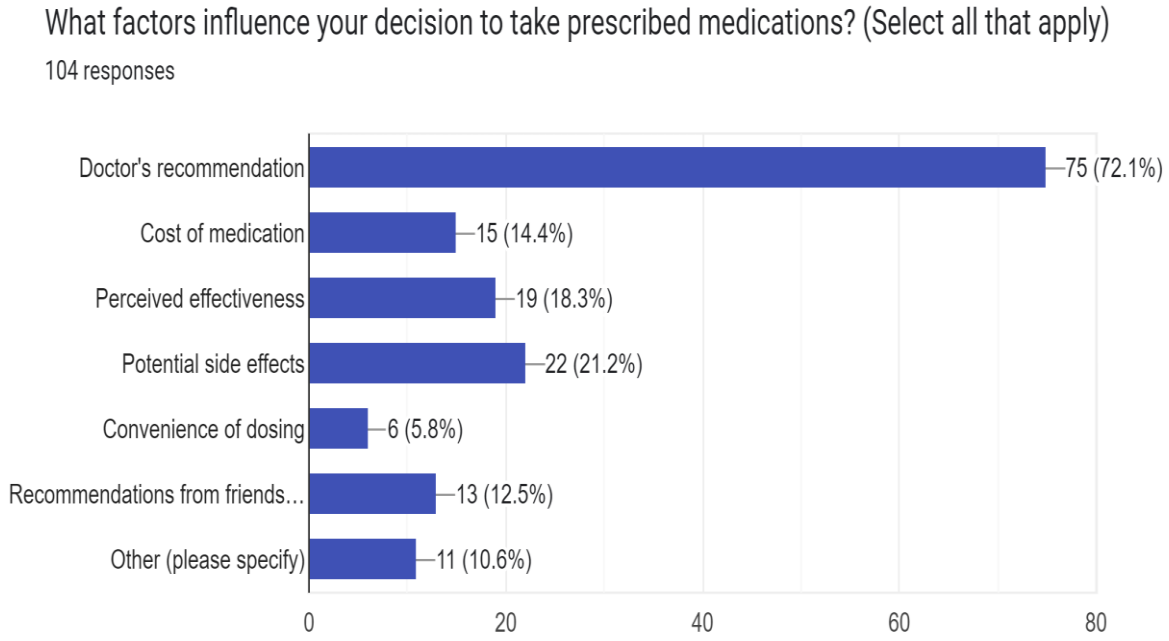


Figure: Distribution of factors influencing intake of prescribed Drugs among respondents

Ease of access to prescribed medications

The dataset is heavily skewed towards the younger age groups, particularly the 18-25 range, indicating a dominance of younger adults in the responses.

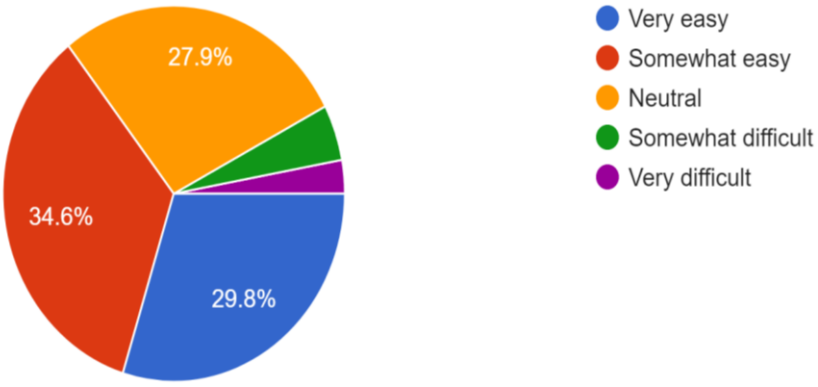


Figure: Distribution of ease of access of prescribed medications among respondents

Sources used to gather information about prescribed medications

The responses provide insight into the various sources respondents rely on to gather information about their prescribed medications.

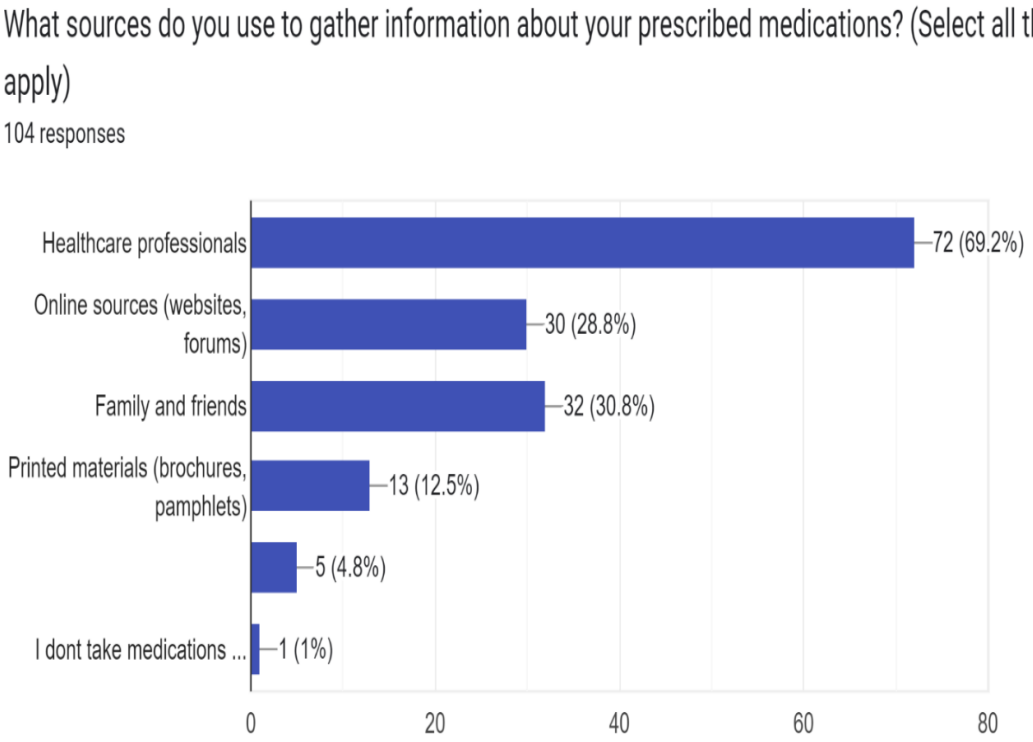


Figure: Source of information about prescribed medications responses

Confidence levels in the safety and efficacy of pharmaceutical drugs

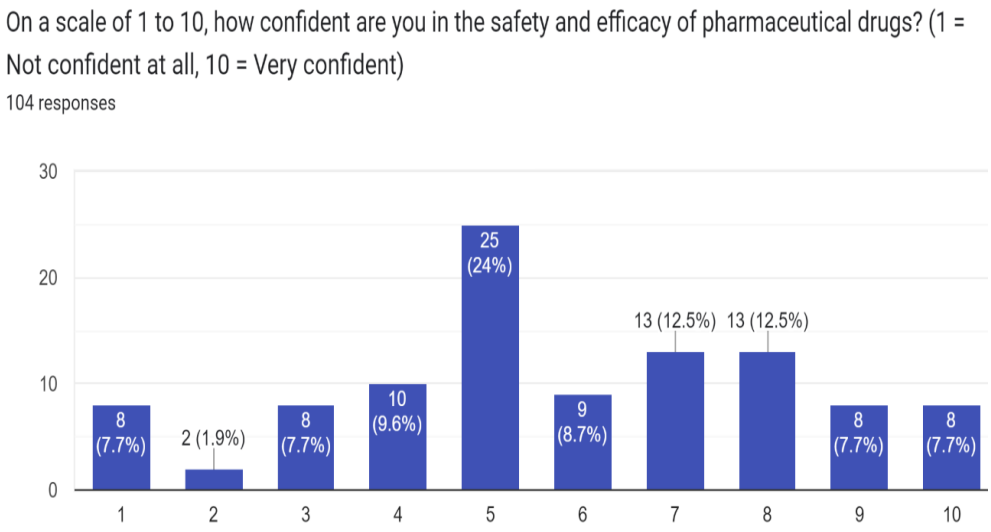


Figure: Confidence level percentage distribution among respondents

Experience of side effects from mental health pharmaceutical drugs

The data set indicates the percentage of respondents who have experienced side effects or adverse reactions from the mental health pharmaceutical drugs they have taken.

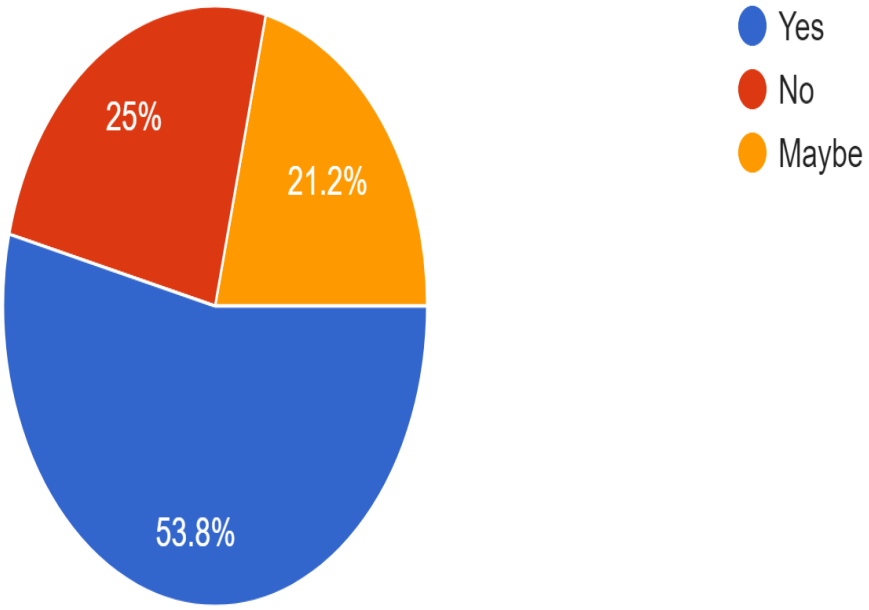


Figure: Percentage of respondents for experience regarding side effects

Overall approach to health and wellness

Responses recorded regarding health and wellness indicate that 38.46% are balanced, 31.73% are reactive and 29.81% are proactive among the respondents.

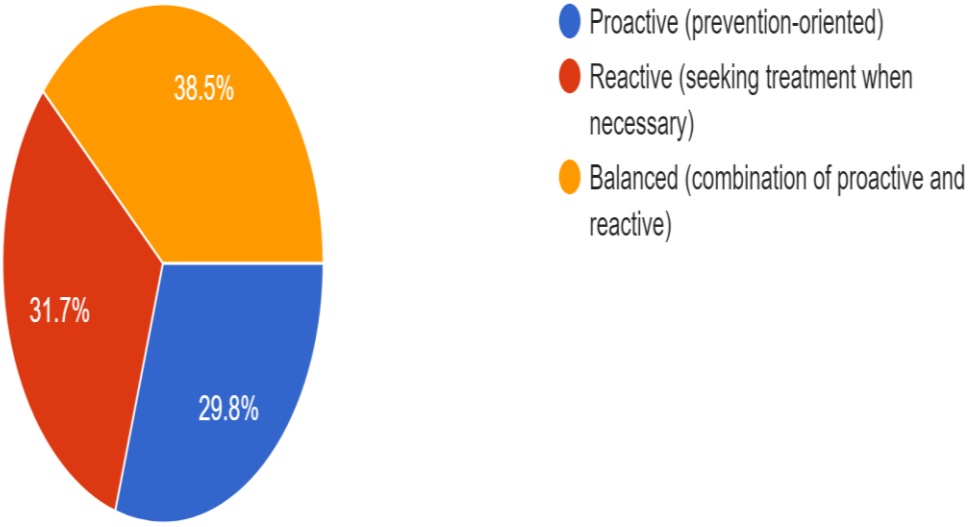


Figure: Distribution of responses regarding health & wellness

Openness to alternative or complementary therapies

Analysis indicates that around 38% of respondents said yes, 34% said No, and 30% said maybe. The overall responses seem mixed, with a slight majority being open to trying new therapies, but with a significant portion also saying No or being unsure. Looking at the distribution can help understand openness to emerging treatments in this population.

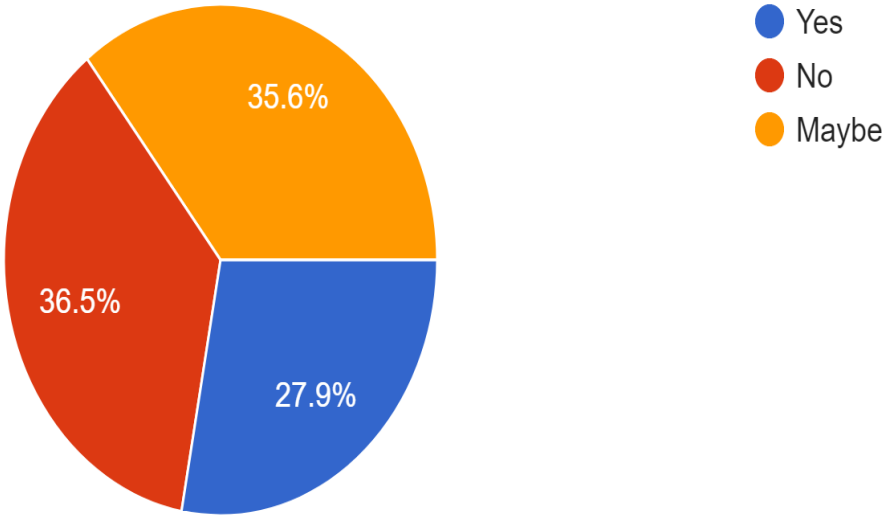


Figure: Distribution of responses for alternative therapies

Discussion

Based on reviewing the variables and hypotheses and the data analysis, there appears to be some alignment demonstrating correlation and dependency between them:

- The skew in the age distribution towards younger respondents (over 60% in the 18-25 range) suggests age may indeed influence medication adherence behaviors, as hypothesized.
- The strong influence of doctor recommendations (75% selected this factor) aligns with the hypothesis about provider influence on medication decisions.
- The impact of side effects (20% selected this) supports the hypothesis about side effects impacting adherence.
- The minimal impact of social media (14% made purchases based on it) corresponds with the hypothesis about social media having limited influence.
- The gender imbalance in the sample (66% male) makes it harder to conclusively confirm gender differences, but the skew is noteworthy.

- The mixed responses about openness to alternative therapies (38% open, 35% not, 31% maybe) aligns with the hypothesis about alternative therapy preferences.

Conclusion

The research investigated factors shaping consumer decisions on pharmaceutical medications. Key findings reveal strong influence of doctor recommendations, impact of side effects on adherence, and effects of age and income on access. Social media had minimal impact. Consumers, primarily younger males and students, were influenced by occupation, access, and confidence in drug safety/efficacy. Reasons for discontinuation included side effects, cost, and perceived effectiveness. Open communication with providers correlated with better adherence. Preferences for generic vs. brand-name drugs affected adherence differently. Overall, the study validated hypotheses on various influencing factors in consumer pharmaceutical decision-making, aiming to understand consumer interaction with pharmaceuticals, economic factors, and their relationship with the industry.

Limitations

- The study relies on self-reported data, which may be subject to bias.

- The sample may not be fully representative of the general population.

- **Sample Size and Representation:** The study analyzed survey responses from 104 participants. While this provides useful insights, a larger and more diverse sample size would increase the generalizability and statistical power of the findings.

- **Demographic Skew:** The data analysis revealed that the sample was heavily skewed towards younger adults (60% aged 18-25) and males (66%). This demographic imbalance limits the ability to draw conclusions about other age groups, genders, or populations.

- **Self-Reported Data:** The study relied on self-reported data from survey responses, which can be subject to various biases, such as social desirability bias, recall bias, or response bias. Self-reported data may not accurately reflect actual medication consumption behaviors.

- **Geographic and Cultural Limitations:** The study was conducted within a specific geographic region, and the results may not be generalizable to

other cultures or countries where medication consumption behaviors could be influenced by different factors.

- **Cross-Sectional Design:** The study collected data at a single point in time, providing a cross-sectional snapshot of medication consumption behaviors. A longitudinal study design that tracks individuals over time could provide more insights into how these behaviors evolve and change in response to various factors.

- **Limited Exploration of Specific Conditions:** The study examined pharmaceutical drug consumption in a broad sense but did not delve into potential differences in consumption behaviors and influencing factors for specific medical conditions or therapeutic areas.

- **Lack of Qualitative Insights:** The study primarily relied on quantitative survey data, which may not capture the nuanced motivations, beliefs, and experiences that shape individuals' medication consumption decisions. Incorporating qualitative research methods, such as interviews or focus groups, could provide richer insights.

- **Omission of Certain Factors:** While the study explored various factors influencing medication consumption, there may be additional factors not considered in the survey, such as the influence of digital health technologies, healthcare system policies, or cultural beliefs and practices.

- **Correlation vs. Causation:** The study identified correlations between various factors and medication consumption behaviors but did not establish causal relationships. Further research would be needed to determine the causal mechanisms underlying these associations.

- **Potential Biases:** Despite efforts to maintain objectivity, the study may be subject to researcher biases in the survey design, data analysis, or interpretation of findings.

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Techniques for Estimating and Quantifying Micro plastics in Water and Organisms

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Abstract

Microplastics are tiny plastic particles, less than five millimeters in size, that are very dangerous to wildlife, humans, and the environment. These particles can originate from a number of sources, such as microbeads used in cosmetic and health goods, resin pellets, and the decomposition of bigger plastic detritus. Since microplastics are so common in the environment and may be found in food, bottled water, air, aquatic habitats, and bottles, there are worries about how they may affect human health when ingested or inhaled. Persistent organic pollutants (POPs) and microplastics interact to show how microplastics may carry toxins and harm marine life before perhaps making their way up the food chain. Microplastics may be identified and measured using sophisticated analytical techniques like flow cytometry and spectroscopy, which also help to understand their distribution and effects on the natural world. Microplastics are widely found in the environment, including aquatic ecosystems, the air, food, bottled drinking water, and food. This highlights the need for sophisticated techniques for precise identification and quantification of microplastics. The diverse sizes, shapes, and chemical compositions of microplastics make them difficult to identify and quantify. The identification of microplastics is aided by the use of spectroscopic methods such nuclear magnetic resonance (NMR) spectroscopy, Fourier-transform infrared (FT-IR) spectroscopy, vibrational spectroscopy, Raman spectroscopy, and hyperspectral imaging. Accurately detecting and measuring minute microplastic particles, particularly those smaller than the light wavelength utilized in optical microscopy, is a problem for these techniques.

Keywords: Microplastics, aquatic environment, Persistent organic pollutants, analytical techniques.

Introduction

Microplastics are tiny plastic particles up to 5mm in diameter. The degradation of plastic waste generates microplastic (MP) particles (**Jiang, B., Kauffman et al 2020**). These particles cause harm to the marine environment including the flora, fauna and the water bodies. plastic was designed to improve human living conditions, but today it has become a real danger to the

environment and the safety of the planet (**Millican et al, 2021**). Plastic waste comes in a variety of forms and sizes, but the term "microplastics" refers to particles that are smaller than five millimeters, or around the size of a sesame seed (**Pradeau et al, 2009**). In the last four decades, concentrations of these particles appear to have increased significantly in the surface waters of the ocean. The most common kind of marine trash/waste is **plastic**.

Primary microplastics with a diameter of less than 5 mm are intentionally manufactured by the plastics industries (**Auta et al, 2017**). This small size makes it possible, among other things, to control the stability and physical appearance of the product or even to have an abrasive effect. Primary microplastics are found in many cosmetics, cleaning products, artificial turf and fishing nets. Microplastic particulates vary with dimension, color, composition, density, and are categorized into different types. Plastic particulates with size range greater than 25 mm, between 5 to 25 mm, 1 to 5 mm, and 1 nm to 1 µm were defined as macro, meso, micro, and nano, respectively (**Lee et al. 2015; Gigault et al. 2018**). Concerning their source and usage, microplastics are categorized as primary and secondary. Primary microplastics are generated microscopically and are present in products for personal care like toothpaste, scrubbers, and other cosmetics (**Duis and Coors 2016; Auta et al. 2017; Fig. 1**).

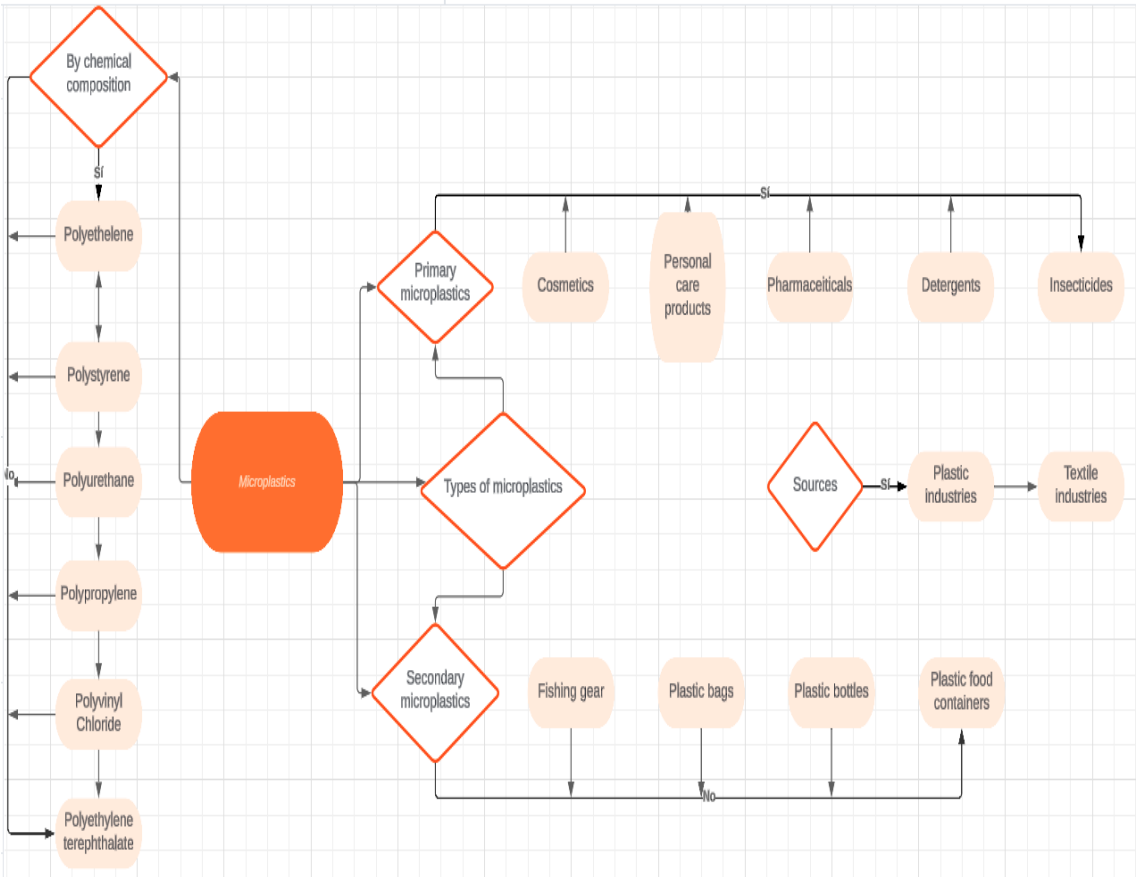


Figure: Types of micro plastics and its source

Against the backdrop of several natural particles, which collectively exhibit an unlimited variety of sizes, shapes, densities, and chemical fingerprints, there is no risk assessment methodology that considers the multidimensionality of microplastic particles. Reviewing the existing paradigms for characterizing the properties and impacts of microplastics, we highlight developments in the examination of the variety of microplastic particles. (**Bucci, Rochman et al 2019**). In comparison to other environmental particles, microplastic has distinct properties. We also provide an overview of the primary processes behind the impacts of microplastic particles and the pertinent dosage metrics associated with these effects. We suggest aligning and quantifying exposure and impact thresholds using probability in order to uniformly represent hazards. (**Koelmans, Paula E. et al, 2017**)

Research Gap

For the analysis of microplastics, standardized procedures and methodologies are essential. Numerous methods for identifying microplastics have been published. This study aims to collect data on the various approaches used to track microplastic contamination in water and organisms, and to understand the persistence and propagation of these particles over time.

Objectives

To collect and summarize the published information on consistent and reproducible methodologies for microplastic identification and quantification, along with the challenges and limitations encountered in this field.

Hypothesis

Using a combination of modern spectroscopic techniques, such as Fourier-transform infrared (FTIR) and Raman spectroscopy, along with innovative sample preparation procedures, can significantly enhance the accuracy and efficiency of microplastic detection in water and organisms. This integrated approach enables more precise and reliable results during analysis and execution of these techniques.

Techniques for Micro plastics Detection and Quantification

Chemical Analysis Techniques for Micro plastics Detection and Quantification

Micro plastics, ubiquitous pollutants in aquatic environments, require precise methods for detection and quantification to understand their distribution, behavior, and potential impacts on ecosystems. Chemical analysis techniques play a crucial role in achieving these objectives by providing detailed information on the composition and characteristics of microplastic particles.

Fourier Transform Infrared Spectroscopy (FTIR)

Fourier Transform Infrared Spectroscopy (FTIR) is a powerful technique for identifying microplastics based on their unique molecular vibrations. By measuring the absorption of infrared radiation, FTIR generates spectra that serve as molecular fingerprints for different polymers (**Arjunan, Naidu, & Parthasarathi, 2023**). This enables rapid and accurate identification of microplastic particles in environmental samples.

Advantages of FTIR

- **Rapid analysis:** FTIR allows for the quick identification of microplastics in complex samples.
- **High specificity:** The unique spectral features of polymers enable precise identification.
- **Minimal sample preparation:** Sample processing requirements are minimal, reducing analysis time and costs.

Limitations of FTIR

- **Interference from contaminants:** FTIR spectra may be affected by coexisting organic and inorganic materials, necessitating careful interpretation.
- **Difficulty in distinguishing similar polymers:** Some polymers exhibit overlapping spectral bands, making differentiation challenging.

Raman Spectroscopy

Raman spectroscopy provides complementary information through molecular fingerprinting, enabling discrimination even in complex matrices

(**Buback, Löder, & Zarfl, 2021**). This technique offers advantages such as non-destructive analysis and high sensitivity. However, fluorescence interference from organic matter and lower spatial resolution compared to microscopy techniques are notable limitations.

Advantages of Raman Spectroscopy

- **Non-destructive Analysis:** Raman spectroscopy is non-destructive, preserving the integrity of the sample.
- **Chemical Specificity:** Provides precise chemical identification, distinguishing between molecular structures.
- **Minimal Sample Preparation:** Requires little to no sample preparation, facilitating rapid analysis.
- **Versatility:** Applicable to a wide range of materials, including solids, liquids, gases, and biological samples.
- **High Sensitivity:** Capable of detecting trace amounts of substances even at low concentrations.

Limitations of Raman Spectroscopy

- **Fluorescence Interference:** Interference from fluorescence can reduce signal quality and complicate analysis, especially with organic samples.
- **Water Interference:** High water content in samples can obscure Raman signals, limiting effectiveness.
- **Sample Heating:** Laser absorption may lead to sample heating, potentially altering the sample or inducing chemical changes.
- **Limited Depth of Penetration:** Restricted to surface analysis due to limited penetration depth.
- **Instrument Cost:** High-quality equipment can be expensive, limiting accessibility.
- Raman spectroscopy, despite its limitations, remains a valuable tool for chemical analysis across various fields.

Pyrolysis-Gas Chromatography-Mass Spectrometry (Pyrolysis-GC-MS)

Pyrolysis-Gas Chromatography-Mass Spectrometry (Pyrolysis-GC-MS) enables comprehensive analysis of polymer composition, facilitating the identification of specific polymer types present in environmental samples (**Koelmans et al., 2016**). This method involves thermally decomposing microplastic particles into volatile compounds, which are then separated and identified using gas chromatography-mass spectrometry.

Recent Advancements and Emerging Technologies

Recent advancements include the integration of artificial intelligence algorithms for automated analysis, enhancing the speed and accuracy of microplastic identification. Machine learning algorithms trained on spectral libraries enhance the efficiency and accuracy of microplastic identification by FTIR and Raman spectroscopy.

Physical Characterization Techniques for Microplastics Detection and Quantification

Microplastics, pervasive contaminants in aquatic environments, necessitate accurate methods for detection and quantification to comprehend their distribution, behavior, and ecological implications. Physical characterization techniques play a pivotal role in achieving these goals by providing detailed insights into the morphology and properties of microplastic particles.

Scanning Electron Microscopy (SEM)

Scanning Electron Microscopy (SEM) enables high-resolution imaging of microplastics, allowing for visualization and characterization of their surface morphology (**Lusher et al., 2017**). SEM utilizes electron beams to scan the surface of samples, providing detailed images with magnifications ranging from 10 to 100,000 times.

Transmission Electron Microscopy (TEM)

Transmission Electron Microscopy (TEM) offers nanoscale imaging capabilities, facilitating the study of the internal structure and composition of microplastics (**Löder et al., 2017**). TEM operates by transmitting electron beams through thin sections of samples, producing high-resolution images with magnifications exceeding 1,000,000 times.

Atomic Force Microscopy (AFM)

Atomic Force Microscopy (AFM) enables precise surface imaging and characterization of microplastics at the nanoscale level (**Cole et al., 2014**). AFM scans a sharp probe over the surface of samples, measuring the interaction forces between the probe and the sample to map surface topography and mechanical properties.

Image Analysis Methods

`Image analysis methods play a vital role in quantifying the characteristics of microplastics from microscopy images (**Horton et al., 2018**). Automated algorithms facilitate size distribution analysis, shape classification, and surface roughness quantification, providing quantitative data for statistical analysis and environmental assessment.

Novel Approaches in Physical Characterization

Novel approaches such as microfluidic devices and nanoparticle tracking analysis offer innovative solutions for physical characterization of microplastics (**Koelmans et al., 2016**). Microfluidic devices enable rapid separation and size-based sorting of microplastics from environmental samples, while nanoparticle tracking analysis provides real-time monitoring of particle size distribution and concentration.

The use of biological assays and biomarkers for microplastic detection in living organisms

A biomarker is defined as a change in biological response, ranging from molecular through cellular and physiological responses to behavioral changes, which can be related to exposure to or toxic effects of environmental chemicals (**Peakall D., Walker et al 2013**).

Over the past few decades, the issue of microplastic pollution has gained increasing attention due to its detrimental effects on marine ecosystems and human health. Biological assays involve exposing organisms to microplastics and monitoring their response, while biomarkers are specific molecular or cellular indicators of exposure to contaminants.

One of the most common biological assays used for microplastic detection is the ingestion assay, where organisms are exposed to microplastics and then examined for the presence of these particles in their tissues. Another approach is the use of biomarkers, such as DNA damage, oxidative stress, and immune response markers, to assess the impact of microplastic exposure on organisms.

Biomarkers Response to living organisms

At the species level, MP intake was shown to cause a unique physiological response in the liver and brain. The liver plays an important part in the cleansing processes of xenobiotics; thus, this tissue is frequently utilized

as a sign of the degree of damage generated by pollutants, especially in the case of MPs**. (L.G.A., Vieira et al, 2017**). Recent advances in molecular biology and biotechnology, as well as the advent of sophisticated tools, have led to the development of fresh, more sensitive confirmed biomarkers of exposure, effect, and susceptibility to the harmful effects of terrestrial and aquatic pollutants (**Galloway T. et al 2014**)**.**

Bioinformatics tools and approaches for analyzing biological responses to microplastics exposure

One of the key tools in bioinformatics for studying biological responses to microplastic exposure is next-generation sequencing (NGS). NGS allows researchers to analyze the entire genome of an organism, providing valuable insights into how it responds to stressors such as microplastics. Metabolomics, or the study of tiny compounds known as metabolites generated by an organism, is another important technique in bioinformatics. Metabolomics can help researchers better understand how microplastics alter an organism's metabolic pathways and find indicators of exposure. In addition to these techniques, bioinformatics provides a variety of methods for investigating biological responses to microplastic exposure. Network analysis, for example, enables researchers to see how genes, proteins, and compounds respond to microplastics. Researchers can use networks to identify important pathways impacted by microplastic exposure and reveal new targets for minimizing their effects.

Limitations

One of the difficulties in combining biological and chemical data is the sheer amount of information. With technological improvements, researchers may now create massive datasets from studies, which can be challenging to maintain and evaluate. The integration process is further complicated by the various types of data obtained from biological and chemical research, such as gene expression patterns, metabolites, and protein interactions. (**Vladimir Gligorijević and Nataša Pržulj, 2015**). Another issue is the absence of uniformity in data formats and metadata. Biological and chemical data are frequently obtained using multiple methods and innovations, resulting in discrepancies. Integrating and comparing datasets from many researches becomes difficult in the absence of common formats and metadata.

Advancements in microplastics detection and quantification

The discovery of new methods for identifying these small particles is a significant breakthrough in microplastics research. Traditional procedures such

as visual inspection and manual sorting are costly and time-consuming, resulting in mistakes in data collection. (**Baljinder Singh, Ajay Kumar 2023**). However, recent advances in spectroscopic methods, such as Fourier-transform infrared spectroscopy (FTIR) and Raman spectroscopy, have transformed the detection of microplastics by enabling the quick and precise identification of plastic polymers.

Researchers can now examine and evaluate the chemical content and shape of microplastics at the nanoscale using modern imaging techniques such as scanning electron microscopy (SEM) and micro-Fourier-transform infrared spectroscopy (μ-FTIR).

Conclusion

Research on microplastics and the methodologies employed to investigate them have brought light on the amount to which they exist in our environment. Despite difficulties and limits, such as sample contamination and size constraints, methods such as Fourier-transform infrared spectroscopy and microscopy have substantially increased our understanding of microplastics' impact on ecosystems. One of the primary benefits of these methods is their capacity to correctly identify and quantify various forms of microplastics, allowing researchers to follow their origins and distribution patterns. This knowledge is critical for creating effective mitigation techniques and policy suggestions to lessen microplastics' impact on marine life and human health. Chemical analysis techniques such as FTIR, Raman spectroscopy, and Pyrolysis-GC-MS play a crucial role in the detection and quantification of microplastics in environmental samples. These techniques provide valuable insights into the composition and characteristics of microplastic particles, aiding in the assessment of their environmental impact.

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Advances in Surgical Management of Vitiligo: A Survey Based Research Analysis

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Abstract

Vitiligo, a chronic disorder, affects approximately 0.5% to 1% of the population. The condition has posed significant challenges for individuals which have been diagnosed and affected with it despite the different treatment options available from medical interventions to surgical as well as topical. There has been a huge advancement in this treatment giving a positive outlook on how to successfully treat the disorder .Vitiligo is mainly progressive at a large percentile and non-progressive at a lower percentile. This disorder is immunologically based, thus, not giving accuracy in definite cure but rather ongoing treatment advances in both medical and surgical outlook offer a promising outlook in further studies on treating it.

Prolonged sun damage and other environmental factors can trigger the immune system to attack melanocytes, the cells responsible for pigmentation, leading to their destruction and resulting in loss of pigmentation. Vitiligo can affect individuals of any age, but it is most commonly seen in early teenagers (around 13 years old) and older adults up to 70 years old.

Out of the 77 patients participating in the research survey, approximately 9.09% have vitiligo. This is consistent with existing data, which indicates that about 1% of the population is affected by the disorder.The survey aimed to review and update on treatment advancements and has successfully provided basic information about vitiligo. It highlighted that while vitiligo is primarily immunological, external factors like sun exposure may also contribute. Though incurable, treatments such as medical and surgical interventions can be beneficial. The findings emphasize the complexity of vitiligo, the need for better understanding and management, and the importance of personalized medical or surgical interventions for effective treatment.

Introduction

Vitiligo is a condition which results in a patchy loss of skin pigmentation (Feng & Lu, 2022). Moreover, hair in these areas of the skin may become white and lose colour over time (*Vitiligo: MedlinePlus Genetics*, n.d.). Each person's

patches vary in size and quantity (*Vitiligo: What Is It, Symptoms, Treatment, Causes, and More*, n.d.). Larger patches of skin tend to lose pigments as the condition deteriorates over time (*Vitiligo: MedlinePlus Genetics*, n.d.). However, in certain afflicted individuals, the patches may stay stable or even get better (*Vitiligo: What Is It, Symptoms, Treatment, Causes, and More*, n.d.).

This is survey-based research to understand the vitiligo burden, patient awareness about the treatment modalities and an understanding of relation between vitiligo and other disease conditions.

Literature Review

Patches of vitiligo develop due to the degeneration of melanocytes in the skin(Feng & Lu, 2022). The cells' called melanocytes are in control of producing melanin. When melanin-producing cells start to die or discontinue to function, due to which vitiligo occurs(*Vitiligo: Diagnosis, Treatment, and Steps to Take*, n.d.;*Vitiligo: What Is It, Symptoms, Treatment, Causes, and More*, n.d.). People with brown or black skin may notice vitiligo more than others, but it affects people with all skin types(*Vitiligo Symptoms, Treatment & Causes | NIAMS*, n.d.). The condition is not communicable or life-threatening(*Vitiligo: Diagnosis, Treatment, and Steps to Take*, n.d.).

Skin is coloured by melanin, which additionally shields it from ultraviolet (UV) radiation from the sun(*Vitiligo: What Is It, Symptoms, Treatment, Causes, and More*, n.d.). Occasionally, there may be a sudden, frequent loss of pigment or colour (*Vitiligo Symptoms, Treatment & Causes | NIAMS*, n.d.;Lin & Fisher, 2007).

Vitiligo is an autoimmune disease (*Vitiligo Symptoms, Treatment & Causes | NIAMS*, n.d.). The immune system's primary role is to protect your body from infections, bacteria, and viruses by confronting them off (*Vitiligo: Diagnosis, Treatment, and Steps to Take*, n.d.). When a particular individual has an autoimmune disease, their immune system unknowingly targets their own (*UV-Radiation, Apoptosis and Skin - PubMed*, n.d.) healthy tissues (*Vitiligo: What Is It, Symptoms, Treatment, Causes, and More*, n.d.). It is possible that those who have vitiligo will also develop other autoimmune diseases more frequently (*Vitiligo Symptoms, Treatment & Causes | NIAMS*, n.d.). It is challenging to say whether and how much the patches will spread (*Vitiligo: Diagnosis, Treatment, and Steps to Take*, n.d.). The patches may stay stable for months or years, or the spread may take several weeks.

This kind of vitiligo, known as universal vitiligo, discolours almost every surface of the skin on numerous body parts (Vitiligo Symptoms, Treatment &

Causes | NIAMS, n.d.). In the most prevalent kind, known as generalized vitiligo, the discoloured patches frequently spread symmetrically (in a similar manner) over matching body parts. Just one side or body portion. This kind, known as segmental vitiligo, usually starts earlier in life, advances for a year or two, and then stops (Bergqvist & Ezzedine, 2020).

Focal or localized vitiligo affects one or a few body parts (Vitiligo: Diagnosis, Treatment, and Steps to Take, n.d.). Acrofacial vitiligo impacts the hands, face, and areas around body openings such as the ears, nose, and eyes (Vitiligo Symptoms, Treatment & Causes | NIAMS, n.d.).

Vitiligo can result due to various reasons such as, the following

- **Genetics:** An estimated 20% of vitiligo sufferers have a first-degree relative who also has the illness. Melanocytes are attacked and killed by the body's immune system in an autoimmune response.
- **Oxidative stress:** Vitiligo can result from an imbalance between antioxidants and oxygen molecules in the body (*Vitiligo Symptoms, Treatment & Causes | NIAMS*, n.d.).
- **Environmental factors:** Vitiligo may result from chemical exposure, sunburn, or emotional distress (*Vitiligo: What Is It, Symptoms, Treatment, Causes, and More*, n.d.).

The development of flat, lighter-coloured spots or patches on the skin is a defining sign of vitiligo (*Vitiligo: Diagnosis, Treatment, and Steps to Take*, n.d.). Often, the first visible white spot is the result of a minor injury or sunburn. It might appear as a plain patch at first, a shade paler than the surrounding skin, but over time, it will get paler and paler until it turns white (*Vitiligo Symptoms, Treatment & Causes | NIAMS*, n.d.). The patches are different sizes and shapes. There may be times when the edges become inflamed, which makes them itchy (*Vitiligo: Diagnosis, Treatment, and Steps to Take*, n.d.). But usually, despite being more prone to sunburn, it doesn't result in any pain, irritation, soreness, or dryness in the skin (*Vitiligo Symptoms, Treatment & Causes | NIAMS*, n.d.).

Variations in over thirty genes, in various combinations, have been linked to a higher risk of vitiligo development (Allam & Riad, 2013). These genes include PTPN22 and NLRP1. The NLRP1 gene codes for a protein that functions in the immune system and aids in controlling the inflammatory process. When the immune system deploys white blood cells and signalling molecules to an injury or disease site in an attempt to combat microbiological invaders and promote tissue healing, the result is inflammation (Sarkar &

Gaddameedhi, 2020). In order to shield its own cells and tissues from harm, the body then reduces (inhibits) the inflammatory response (*Vitiligo: MedlinePlus Genetics*, n.d.). The PTPN22 gene codes for a protein that is involved in signalling and helps regulate T cells, which are immune system cells. T cells protect the body from infection and recognize foreign substances (*Vitiligo: MedlinePlus Genetics*, n.d.). The NLRP1 and PTPN22 proteins' activity is probably impacted by the mutations in these genes that are linked to a higher risk of vitiligo, which makes it more challenging for the body to regulate inflammation and stop the immune system from attacking its own tissues(*Vitiligo: MedlinePlus Genetics*, n.d.).

It is unknown what particular conditions cause the immune system to target skin melanocytes (*Vitiligo: What Is It, Symptoms, Treatment, Causes, and More*, n.d.). Studies indicate that when melanocytes are stressed by chemicals or UV radiation, the immune system of those who are impacted may respond abnormally(*Vitiligo: What Is It, Symptoms, Treatment, Causes, and More*, n.d.). Furthermore, vitiligo sufferers may have melanocytes that are more sensitive to stress than the general population, making them more vulnerable to immune system attacks(*Vitiligo: Diagnosis, Treatment, and Steps to Take*, n.d.). Numerous unknown genetic and environmental factors, many of which are combined, are likely the cause of the condition(*Vitiligo: MedlinePlus Genetics*, n.d.). Research indicates that in individuals who are predisposed to the condition, vitiligo may be brought on by psychological stress, UV radiation exposure, or contact with specific chemicals or skin-whitening products(*Vitiligo: MedlinePlus Genetics*, n.d.)(*Vitiligo: What Is It, Symptoms, Treatment, Causes, and More*, n.d.)(*Vitiligo Symptoms, Treatment & Causes | NIAMS*, n.d.).

Research Gap

A literature search was conducted in the NCBI PubMed database, which yielded scattered papers. Therefore, this survey was designed to comprehensively understand various parameters, as some papers focused solely on clinical aspects while others discussed the history of vitiligo.

Objectives

In this research paper, the authors aim to find out the prevalence of vitiligo in Indian population realize the social stigma of the patients of vitiligo and give an overview of the treatment methods available to the patients of vitiligo and the awareness level of the patients in line with the recent developments.

Hypothesis

The hypothesis of the study is that the prevalence of vitiligo in Indian population should be in line with the population and that the patients have a good level of awareness about the medical and surgical interventions available for the management of vitiligo.

Research Methodology

A comprehensive questionnaire was crafted consisting of 25-30 questions, with diverse range of inquiries involving multiple-choice questions, short answer types question and for some questions, responders were allowed to upload pictures. The survey was executed utilizing the Google Forms platform, necessitating participants to log in to their email accounts, therefore limiting multiple entries from a single account. The questionnaire was circulated through various channels, including social media platform, QR scan code and standard messaging services. The questions were to be answered by both the population, meaning population with vitiligo and population without vitiligo. The respondents vary in different types of profession, background and age group.

Study design

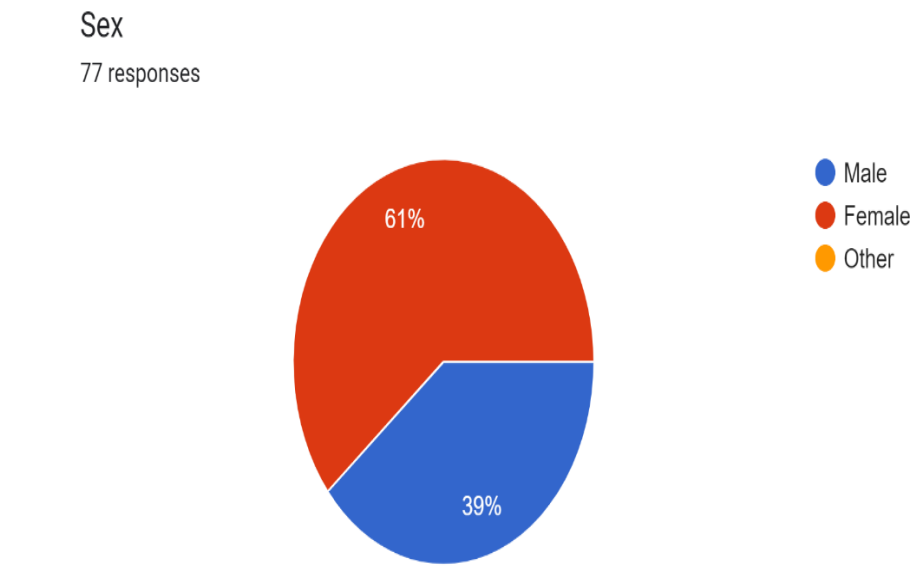
A web-based survey was conducted through Google Forms online platform since January 2024. The online survey questionnaire contained two sections:

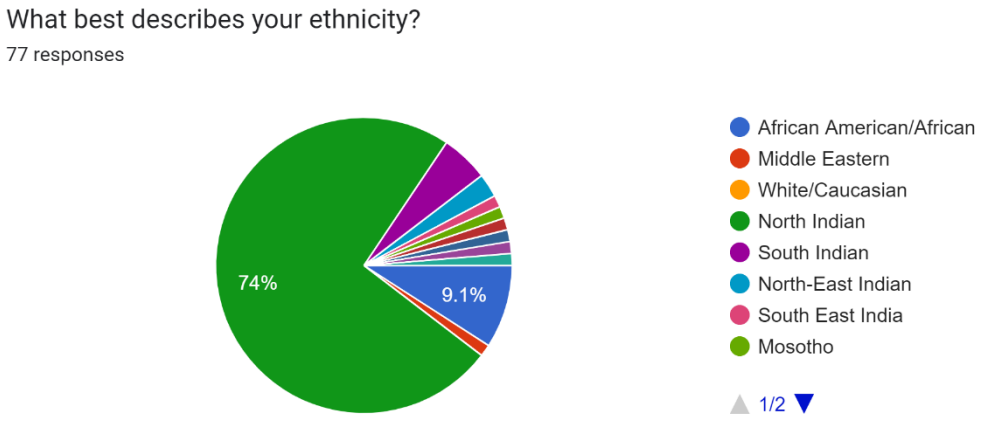
1. In the first section, participants were asked to fill their personal information such as name, email id, date of birth and general demographics including age, city born in, native place, ethnicity and eye colour. The main question in this section was asking the participants whether they have vitiligo or not.

2. The second section of the questionnaire was only to be filled by the participants with vitiligo. The participants were asked to respond to questions regarding there vitiligo progression, onset of the vitiligo, awareness about available treatment options, particularly the recent developments using stem cell trials, which provided us with more in-depth information regarding the vitiligo frequency burden, medical and surgical therapy awareness and relation of vitiligo with other disease predisposing.

Figure: QR code which was used to circulate the Google Form for the questionnaire.

Results





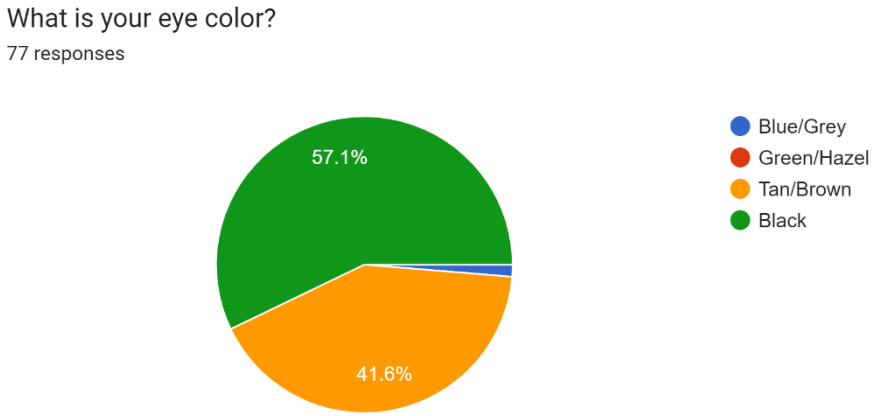


Figure: Specific Parameters of the Population

People from different ethnicity participated in this survey but north Indians being the major population.

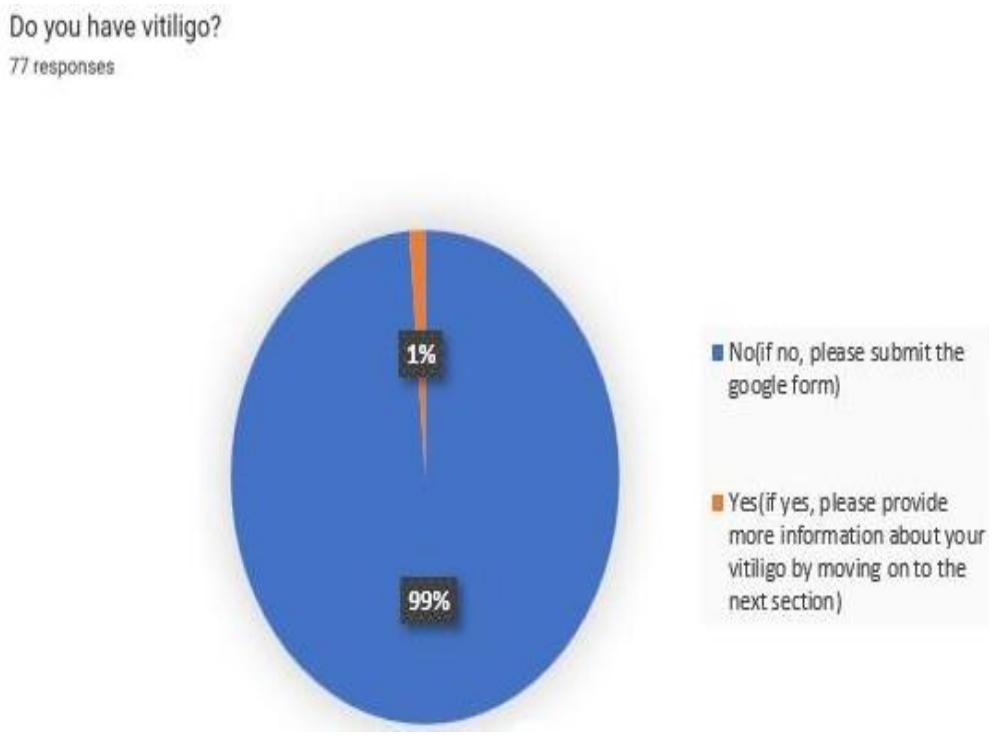


Figure: Response to Vitiligo

This was the main question asked from our participants. This was the question which gave us the frequency of people having vitiligo in our participants. Only 1% of our participants were affected by vitiligo that is the same percentage of the affected individuals globally.

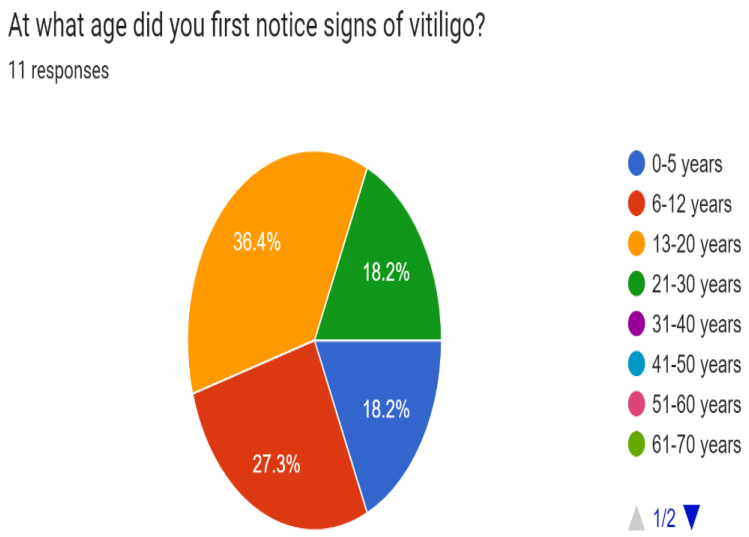


Figure: Age Profile of Vitiligo patients

Vitiligo was found to affect a predominant age group of 10-30 years and may appear at any age.

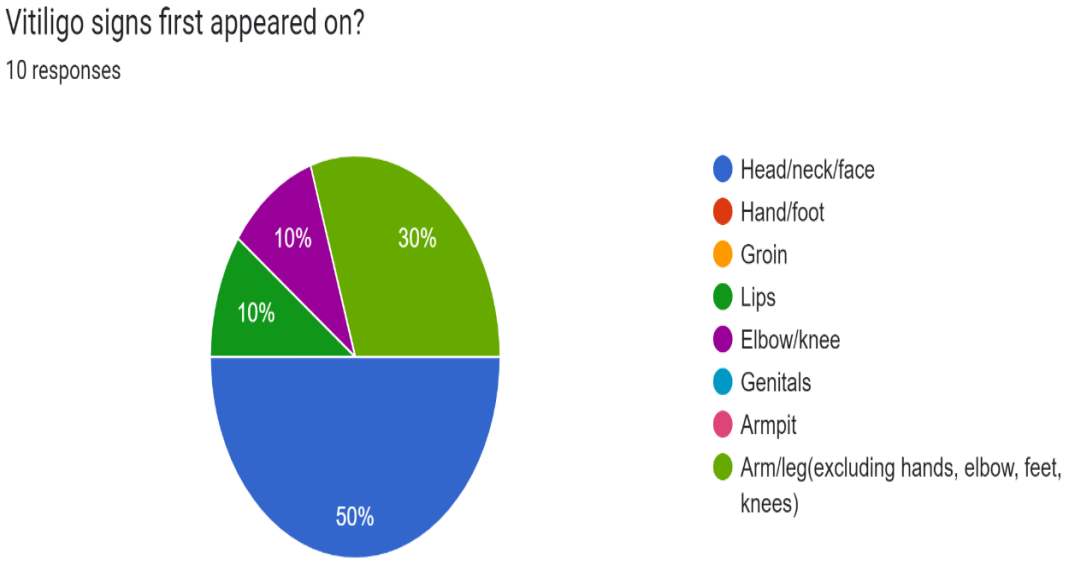


Figure: Profile of Body Parts showing first signs of Vitiligo

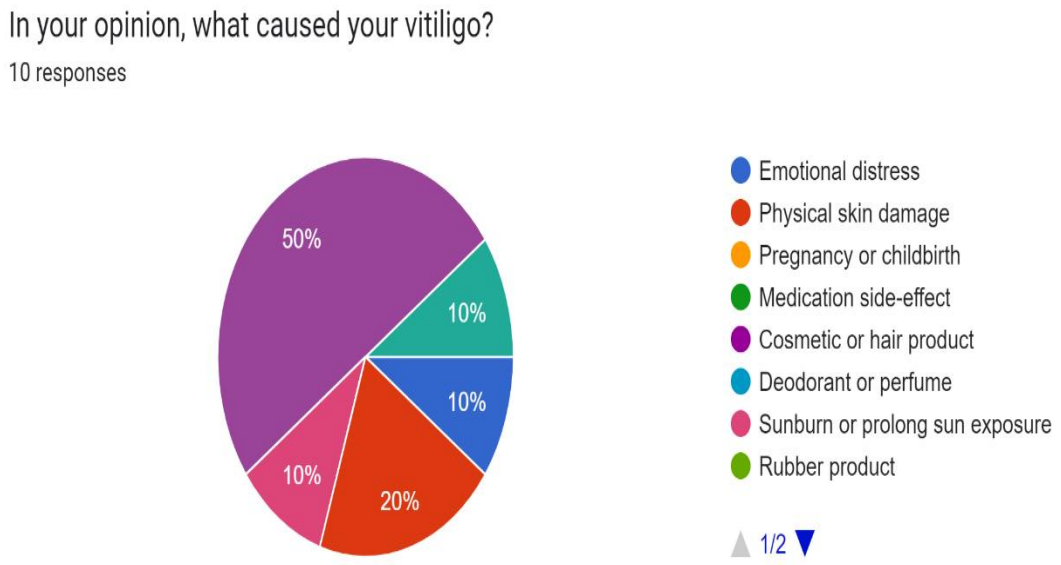


Figure: Reasons for Vitiligo

The main cause or factor of vitiligo that was acquired by the majority of the population was found to have been caused by 50% cosmetic products, 20% sunburn and prolonged sun damage with emotion and physical factors equally at a 10% factor rate.

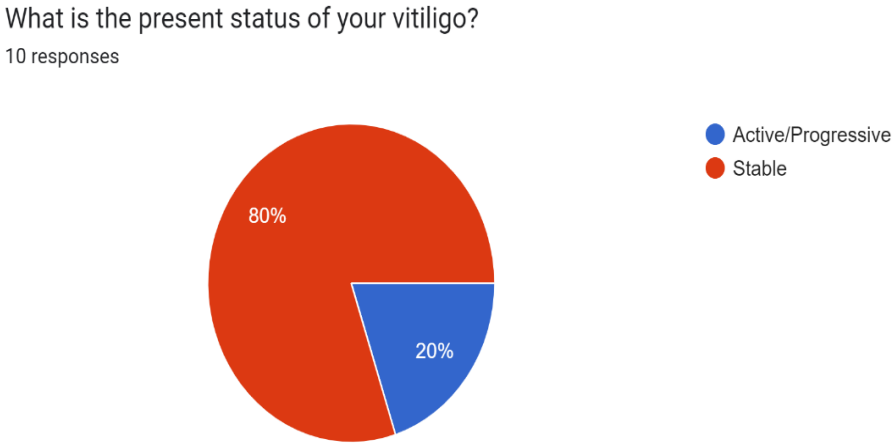


Figure: Present Status of Vitiligo

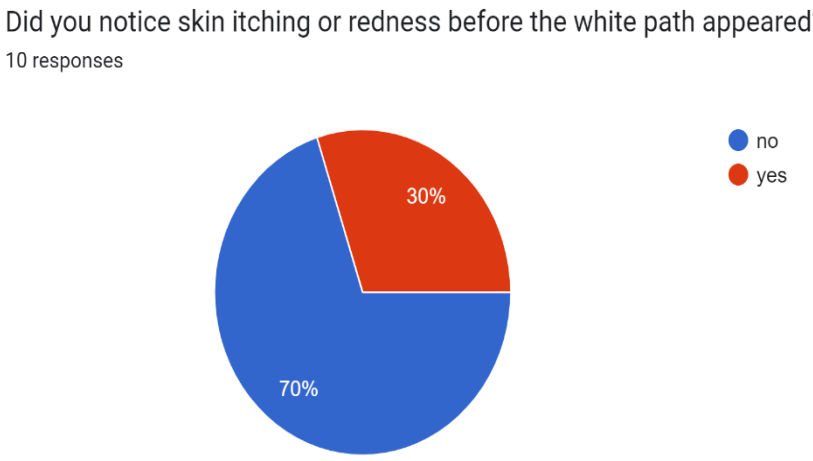


Figure: Skin Status of Patients

Vitiligo is immunologically linked and often presents itself with symptoms such as itchiness around affected area of skin viz., the eyebrow site and hands with itchiness presenting itself with a percentile of 70% which is also associated with redness or red patches around the area.



Figure: Profile of Skin Colour of Patients

This depigmentation disorder affects all skin types ranging from black, brown, fair and medium tones in between the black and white communities. Even though the disorder affects all tones, it is more noticeable or observable in darker skin tones or more dominant for intermediate brown and toned skin tones / brown and black.

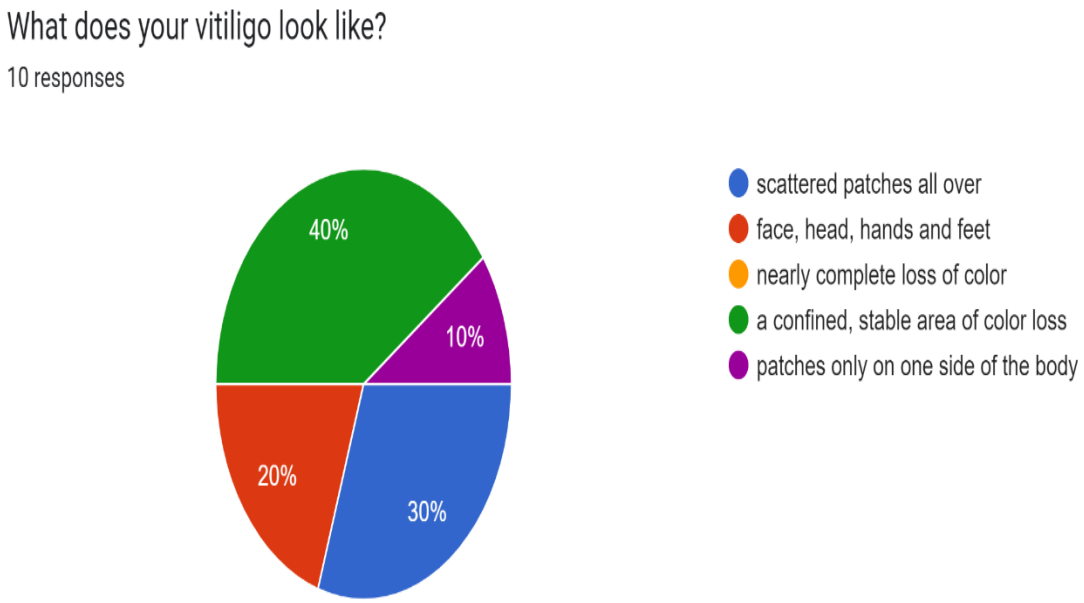


Figure: Appearance of Vitiligo

The affected site of the vitiligo is visible mostly in the following pattern and characteristic of which 40% of the affected area is a stable and localised area of de-pigmentation on affected site. Sometimes the affected site may be localised on different areas of the skin or maybe scattered sometimes at a percentile of 30% on different affected sites. 10% of the time, vitiligo may present itself on one site of body and sometimes 20% of the time may be observable in patterns of depigmentation on the hands, face and feet.

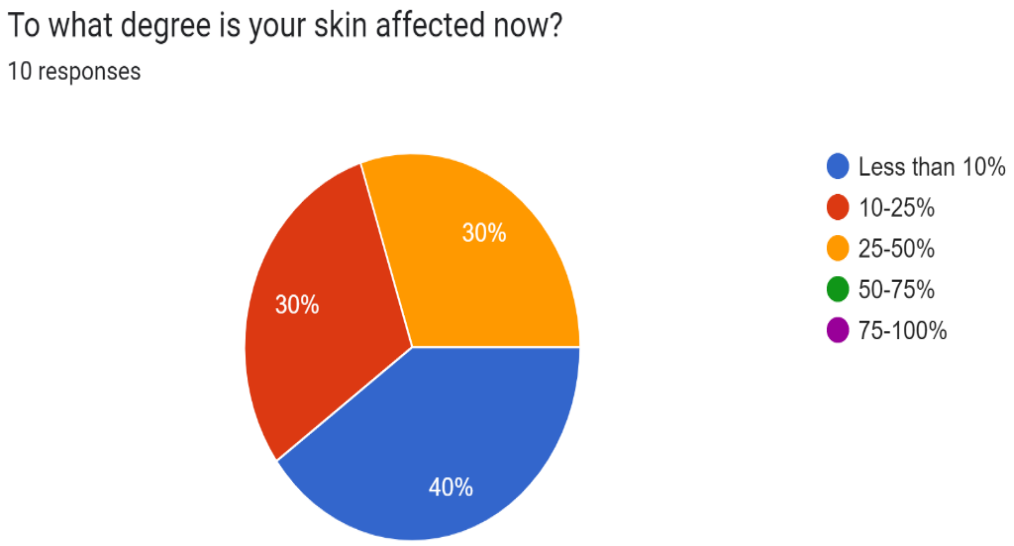


Figure: Status of Affected Skin

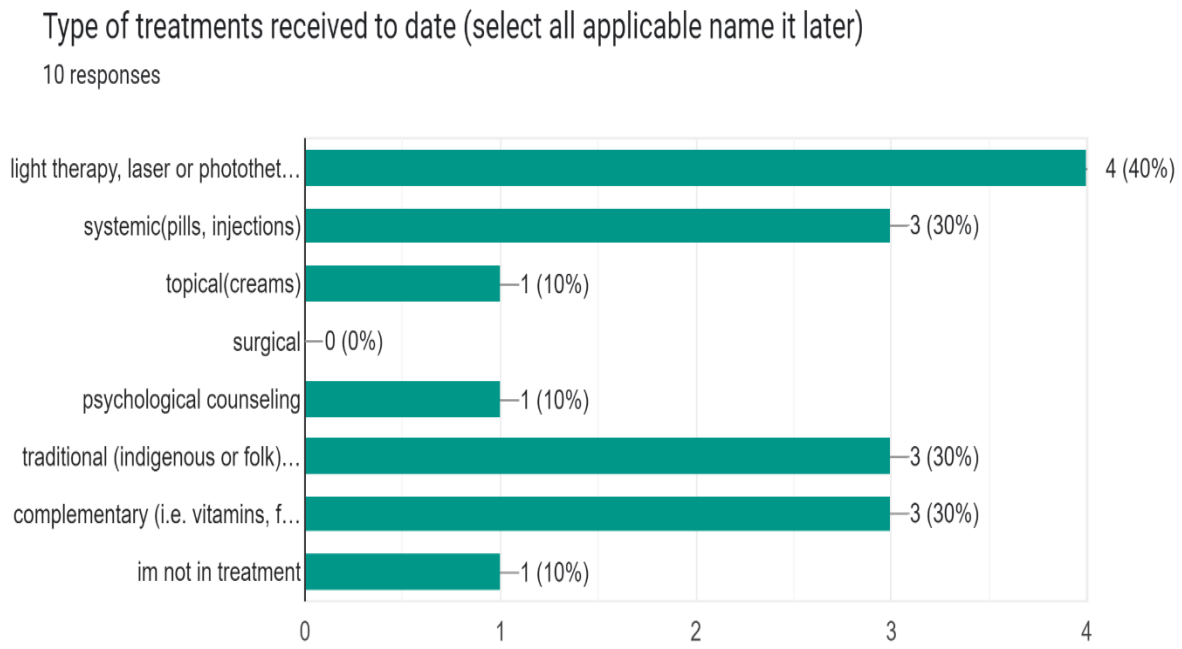


Figure: Types of Treatments received for Vitiligo

There are many interventions which can be used in management of vitiligo; light therapy being the most popular and systemic pills/injections; traditional (indigenous or folk) medicine and complementary (i.e. vitamins and food supplements) being second most popular among our participants. 10% of the population was interested in topical creams and psychological counselling. There were also people who were not interested in getting a treatment.
Surgical treatment was also the least prioritized option, with 0% awareness among participants.

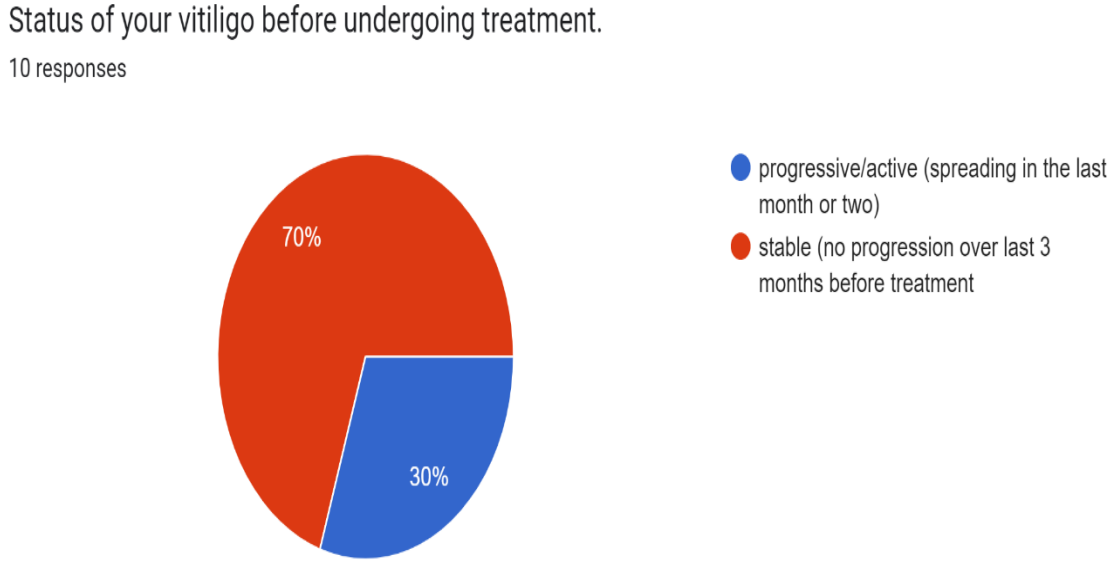


Figure: Status of Vitiligo before Treatment

Majority of the participants had stable vitiligo after undergoing the treatment for vitiligo.

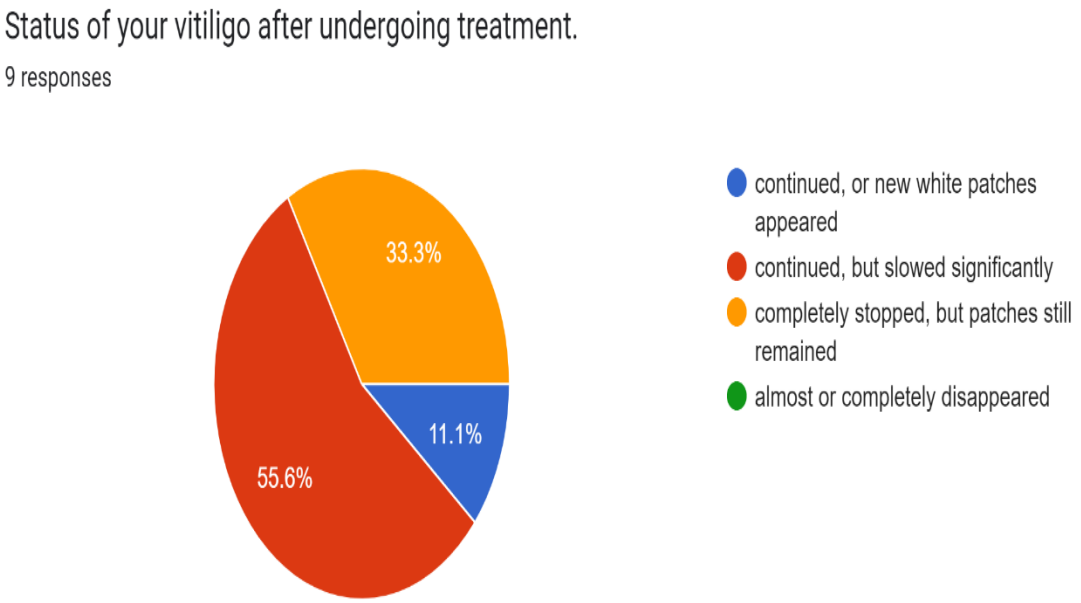


Figure: Status of Vitiligo after Treatment

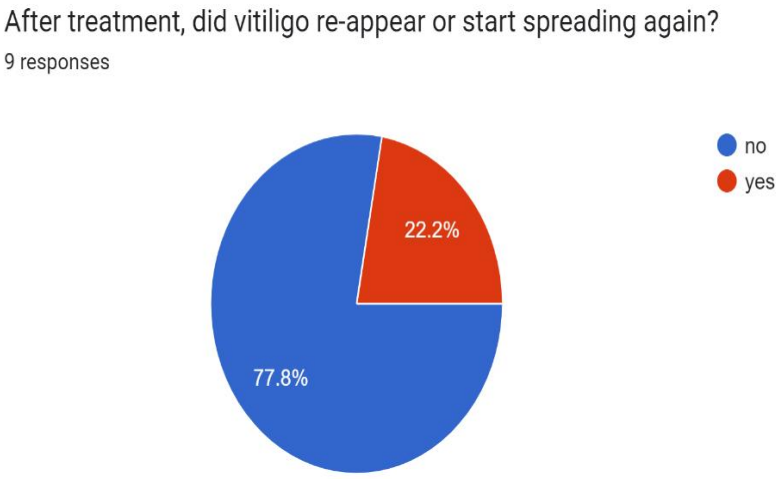


Figure: Reappearance of Vitiligo after undergoing Treatment

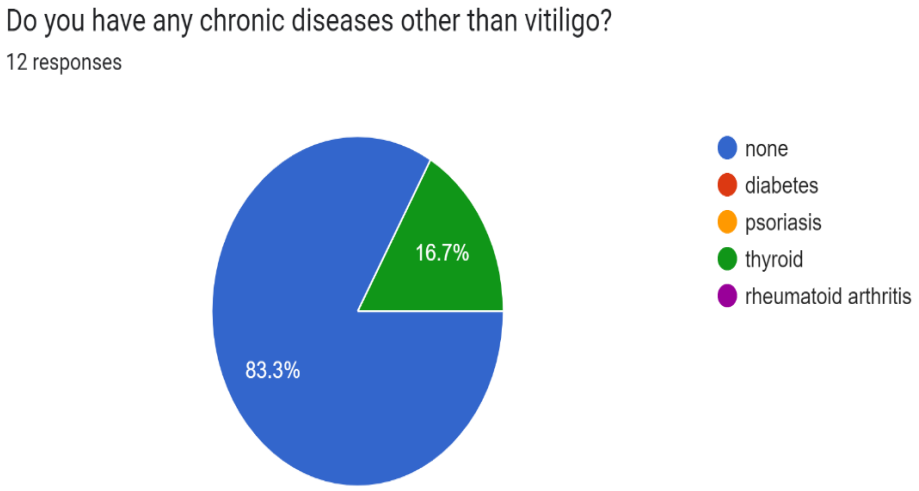
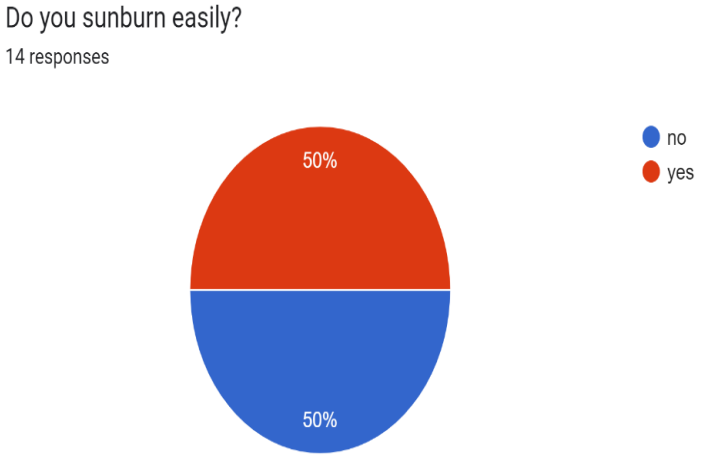
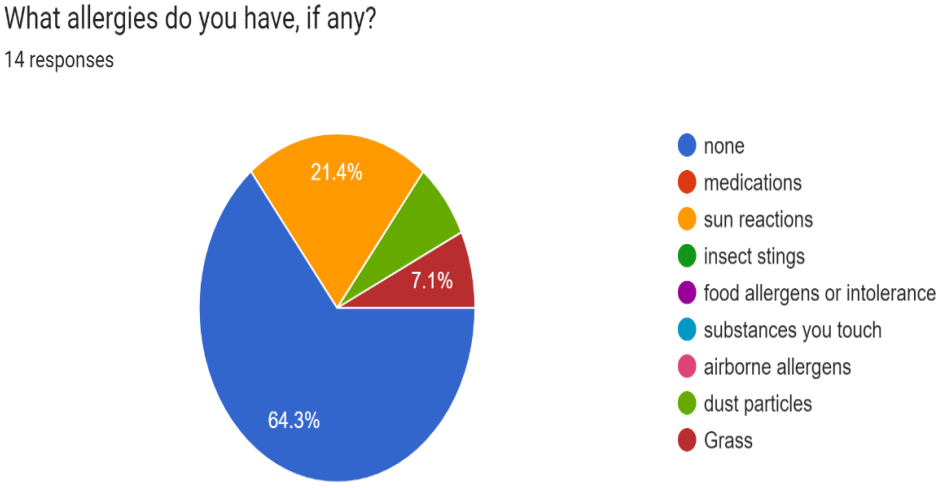


Figure: Status of any other disease beyond vitiligo

Majority of the participants did not have any other chronic disease other than vitiligo but it was observed that a small number of people had thyroid.





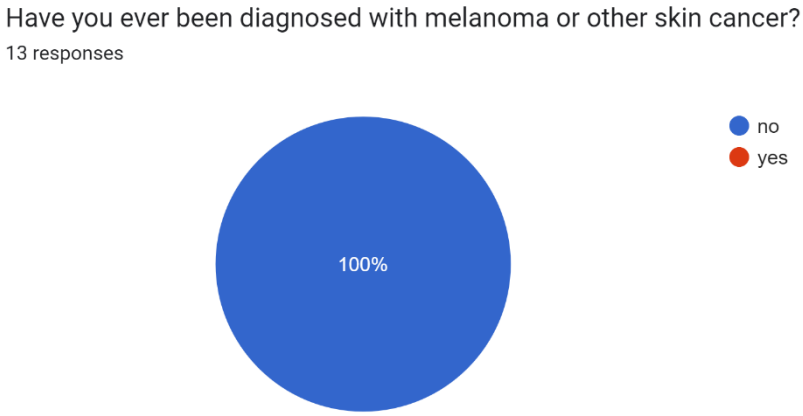


Figure: Status of other Allied Parameters for Vitiligo

None of the participants were diagnosed with melanoma or any other skin cancer. So, in this particular survey, there was no relation of vitiligo with skin cancer. However, a larger study will be required to conclude it.

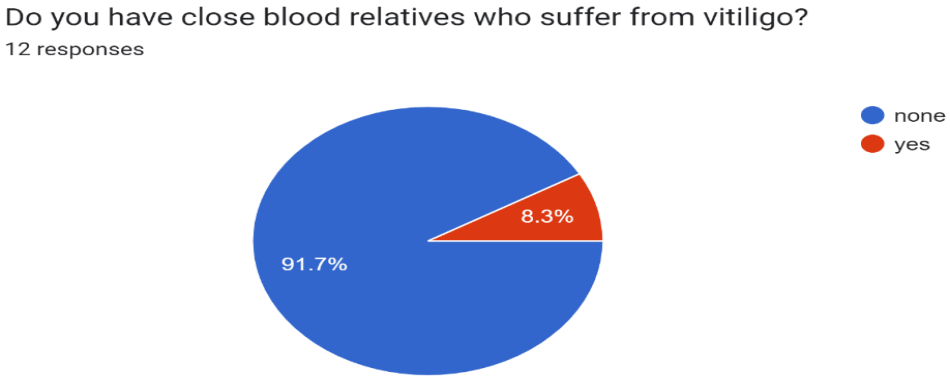


Figure: Status of Vitiligo for Relatives

Though, vitiligo is a multifactorial condition and has been proven to have link with genetic predisposition, in this particular survey there was no such participant.



Figure: Vitiligo affected areas in patients

Above are the illustrations that depict the disorder of vitiligo on different sites of the affected individual's body, like hands, arms, face, etc. These pictures were collected through the Google form which was circulated amongst the participants.

Conclusion

Based on the survey data, it can be concluded that vitiligo occurs with a 1% frequency within the population studied, which is same as the frequency of people with vitiligo globally. This information could be valuable for understanding the prevalence and distribution of vitiligo, potentially informing healthcare strategies and resources allocation for affected individuals. Further analysis may reveal trends regarding genetic, gender, geographic location, and other factors associated with the condition.

Future Discussion

- Exploring Risk Factors: Further investigation can be done to find potential risk factors associated with the development of vitiligo within the population, such as genetic predisposition, environmental triggers, or comorbidities.

- Impact on Quality of Life: Assessment can be done on the psychological and social impact of vitiligo on individuals' quality of life, including experiences of stigma, coping mechanisms, and access to support services.

- Treatment Accessibility and Effectiveness: More evaluation of the availability, affordability, and effectiveness of treatment options for vitiligo within the surveyed population, considering factors such as healthcare access, insurance coverage, and patient satisfaction.

- Community Outreach and Education: Development of educational initiatives and community outreach programs to raise awareness about vitiligo, reduce stigma, and promote early detection and treatment can be done.

- Genetic and Immunological Research: Underlying genetic and immunological mechanisms involved in the development and progression of vitiligo can be explored with the aim of identifying new therapeutic targets and personalized treatment approaches.

- Comparative Studies: Comparison of the prevalence and characteristics of vitiligo across different populations, ethnicities, and regions to identify
  Potential disparities and inform culturally sensitive health care interventions can be further explored.

Limitations

The limitations of the vitiligo studies is centres around the constraints and factors that affect the absolute validity of the findings of this study of vitiligo. Some of those constraints were:

- The Difficulty In Finding A Diverse Group Of Individuals Mainly From Other Parts Of India And The World In General; Mainly The Research Was More Localised Around The State Of Haryana And The Indigenous

Population Of India Within This State Of Which 0.5% -1% Have Acquired The Disease .

- There Has Been A Difficulty In Tracking The Progression And Definitive Cause Of The Disease;: Vitiligo Is Affecting A Limited Part Of The Entire World Population And 1% Of A Population Has Been Difficult To Track Or Find The Definitive Amount Of People Affected With It As It Is Also Difficult To Find A Definite Cause And Amount Of Population Affected Population

- As An Immunological Disorder Where Pigment Cells Are Attacked, Vitiligo Is Particularly Challenging To Track Within The Population.

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Liquid and Organic Electronics – A New Path to an Old Problem

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Abstract

This is an innovative study in the search for an alternative semiconductor system, which has resulted in the development of a unique contact structure using a liquid ionic species to mimic the responses of the conventional electronic devices. The study has shown that the system is a one-time use unique system, using low cost materials, yet providing the necessary electronic output.

Introduction

All electronic devices like mobile phones, laptops, computers, radios, CDs, etc. use semiconductors in their cores as their basic functioning units. Semiconductors are those materials which have their electrical conductivity between conductors and insulators. This is because of the placement of their energy band gaps.

An energy band gap (Eg) or band gap or energy gap is the energy range which exists between the top of the valence band and bottom of the conduction band of a material. This is the region where electrons cannot exist. The electron will either be present in the valence band or if it is provided with sufficient energy will move to the conduction band and therefore it will be free to move within the crystal lattice of the material and will act as the charge carrier for conduction of electricity. The bands consist of a large number of energy levels which actually contain the electrons that are needed for electrical conduction.

Conductors are materials which have overlapped valence and conduction bands and thus the electron does not require any energy to move to the conduction band. So the electron freely moves from the valence band to the conduction band and into the crystal lattice enabling continuous conduction of electricity. This implies that their energy gap (Eg) = 0eV. All metals except for mercury are examples of electrical conductors. Graphite which is a non-metal is also a unique example of an electrical conductor.

In semiconductors, this energy gap is non zero as there is a small gap between the two bands. These gaps are different for different semiconductor materials thus enabling them to be used in different devices for different purposes. For Silicon (Si) the energy gap (Eg)= 1.1eV thus the electron of silicon requires 1.1 eV of energy to move to the conduction band. For Germanium (Ge) the energy gap (Eg)= 0.7eV. These two materials are the most widely used semiconductors in microchip manufacturing used in computers.

In insulators, this energy gap is more than 3eV, thus, insulators require a lot of energy to make electrons flow through it. Hence insulators do not conduct electricity. Glass, rubber, wood, etc are some examples of electrical insulators. Generally, all non-metals except for graphite and some composite non-metals are electrical insulators.

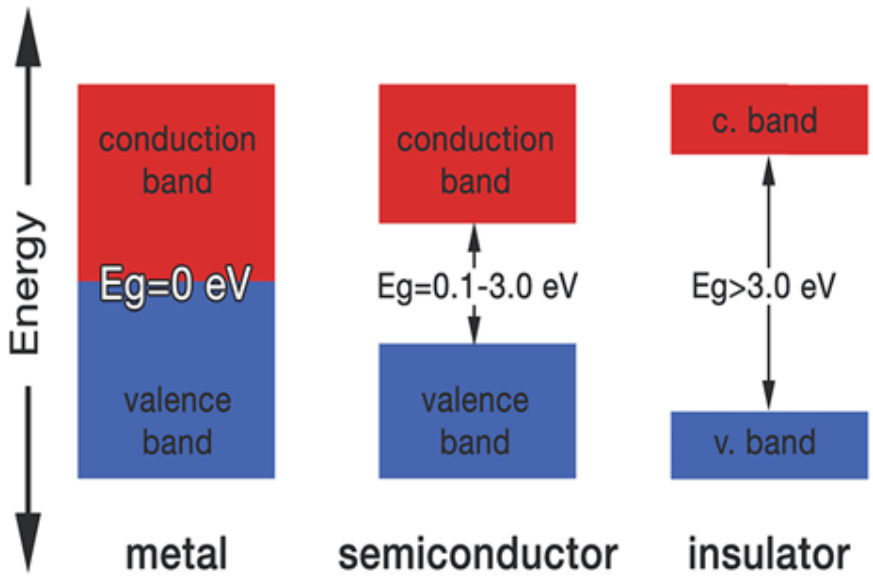


Figure: Energy band gaps of different materials.
Source: https://www.researchgate.net/figure/Energy-band-diagram-demonstrating-different-band-gap-energies_fig13_270663139

Semiconductors are mainly classified into 2 types- elemental and compound semiconductors. Silicon and germanium are examples of elemental semiconductors. Materials like Gallium-Arsenide (GaAs), Gallium-Nitride (GaN), Silicon-Carbide (SiC), Indium-Phosphide (INP) and even Aluminium-Gallium-Indium-Phosphide (AlGaInP) are some examples of compound semiconductors.

Elemental semiconductors are used to make basic electronic devices like P-N junction diodes, Bipolar Junction Transistors, Metal Oxide Semiconductor Field Effect Transistors, Junction-Field Effect Transistors, etc. these devices are

known as active devices as they allow us to control the output by changing the input. These devices combined with passive devices like resistors, capacitors, inductors are used to make circuits called Integrated Circuits which are the building blocks of microchips used in computers.

Compound semiconductors are used to make opto-electronic devices like Semiconductor Lasers, Light Emitting Diodes (LEDs), photodiodes, etc which have many uses in the modern electronics world.

Electronic Devices

Electronic devices are the instruments used in controlling the flow of electrons used for the purpose of transferring of information and controlling systems and are majorly used in any devices which are automated for any function. Some of the most basic electronic devices are p-n junction Diodes commonly known as diodes, zener diodes, BJTs, MOSFETs, JFETs, etc.

Diodes

A diode is the simplest and the most basic semiconductor device which acts as a valve to the flow of electrons i.e., for the current. This ensures that the current flows in only one direction. Diodes are of many types like P-N junction Diode, Zener Diode, Schottky diode, Laser Diode, etc.

A P-N junction diode or simply diode is an electronic one way valve which is made up of a p type material in junction with an n type material.

A p type material is formed when a group 14 element(silicon or germanium) is doped with a group 13 element(boron, aluminium, etc) in order to increase the majority charge carriers.

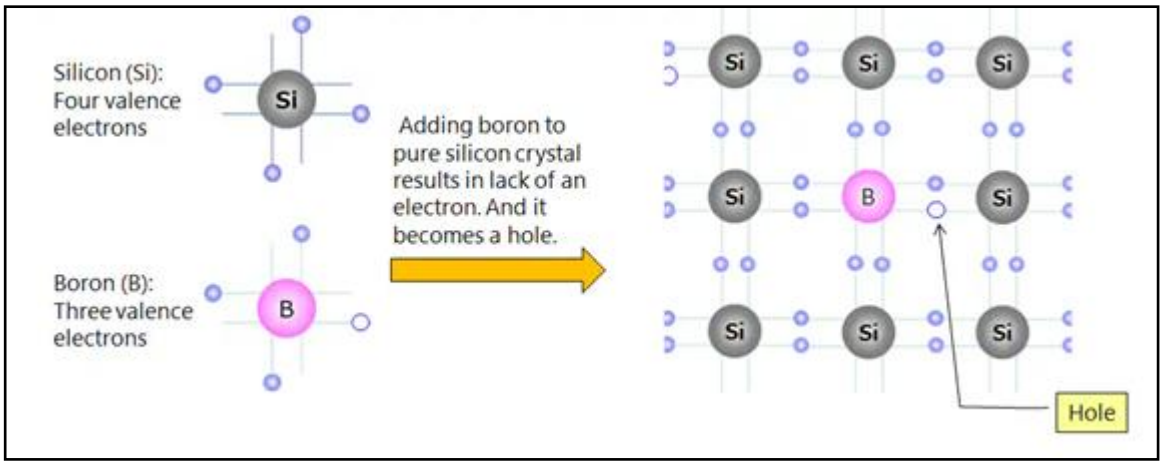


Figure: Doping of silicon to make the p-side of the diode
Source:https://toshiba.semicon-storage.com/content/dam/toshiba-ss-

Doping is the process of adding impurities to a pure semiconductor also known as an intrinsic semiconductor. Thus, the process of doping results in the production of an extrinsic semiconductor (impure semiconductor).

As depicted in figure 2(a), a group 13 element, for eg: boron consists of 3 electrons in its valence orbitals however silicon being a group 14 element consists of 4 electrons in its valence orbital. So when the boron enters the lattice of the silicon crystal, its 3 electrons bond with the 3 electrons of the silicon atom the one remaining electron is bonded with an absence of an electron (also known as a hole). This hole is considered a charge carrier in a p-type semiconductor.

An n type material is formed when a group 14 element (silicon or germanium) is doped with a group 15 element (nitrogen, phosphorus, etc). These group 14 elements are intrinsic semiconductors.

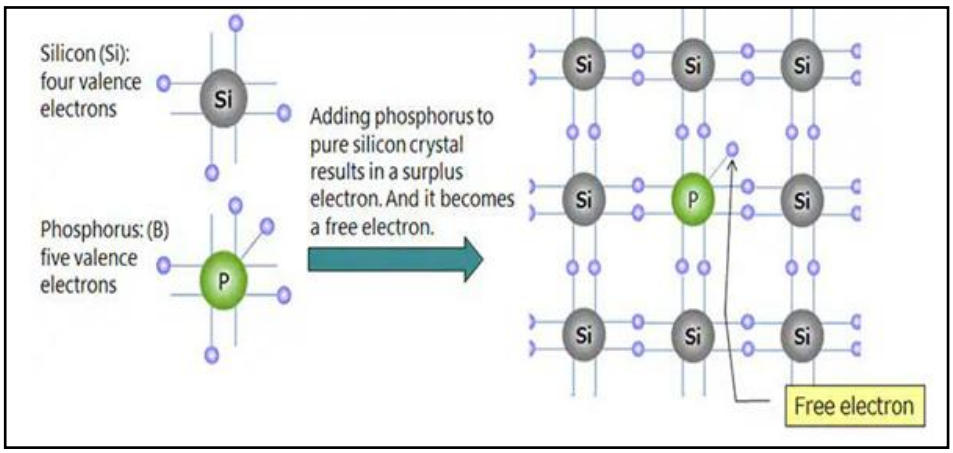


Figure: Doping of silicon to make the n-side of the diode
Source:https://toshiba.semicon-storage.com/content/dam/toshiba-ss-

As depicted in figure 2(b), when a group 14 element like silicon is doped with a group 15 element like phosphorus containing 5 electrons in its valence shell will have 4 of its electrons bond with the 4 electrons of silicon and the remaining 1 electron becomes free to move in the crystal lattice, thus becoming a charge carrier for conduction of electricity.

After the process of doping is completed, theoretically, the p and n sides are joined together thus forming a p-n junction. In this junction, electrons from the n-side move towards the holes present on the p-side. This movement of majority charge carriers to the other side results in the formation of a region that is devoid of the original charge carriers. This layer is called the depletion layer or depletion region. The manipulation of this depletion region in different biasing combinations is essential in making full use of the p-n junction diodes.

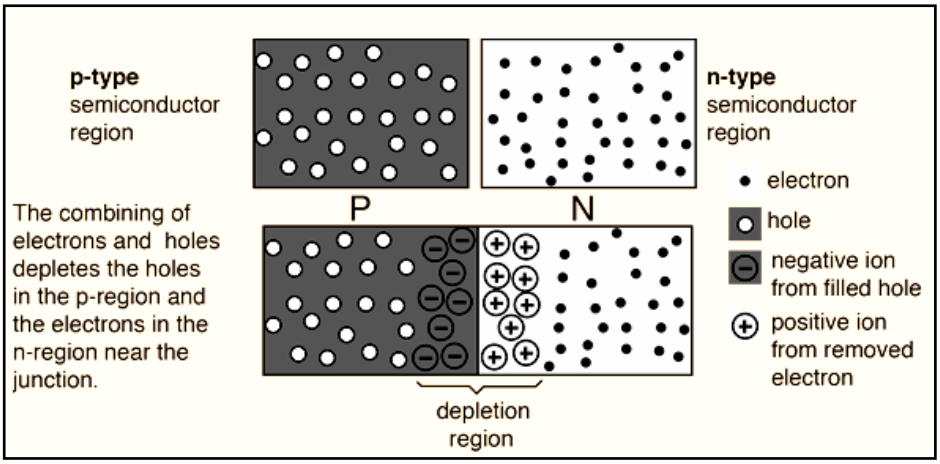


Figure: Depletion region of a P-N junction diode
Source: http://hyperphysics.phy-astr.gsu.edu/hbase/Solids/imgsol/pn2.png

A P-N junction diode is used in every kind of electronic device because of its application as a one-way valve for electrons (hence restricting the current), AC-DC rectifier, and manufacture of other electronic devices like transistors.

On the application of a potential difference across the diode, it acts as a non-linear resistor where it starts to draw a huge amount of current after a certain value of potential. This potential is called the knee voltage of the semiconductor material. However, before this potential the amount of current flowing in the diode is near to zero and thus is neglected during operation. Potential can be applied in two ways: forward application or forward bias and reverse application or reverse bias.

In forward bias, the positive terminal of the battery is connected to the p-side of the diode and the negative terminal of the battery is connected to the n-

side of the diode. The characteristics of the voltage and current in this biasing are as mentioned above.

In reverse bias, the positive terminal of the battery is connected to the n-side of the diode and the negative terminal of the battery is connected to the p-side of the diode. In this, the diode does not allow the flow of charge carriers because the reverse polarity across the diode causes the depletion region to increase in width hence restricting the flow of current. So the diode in reverse bias is considered in an off state. These voltage-current variances are called V-I characteristics of the diode and are essential for their production and application.

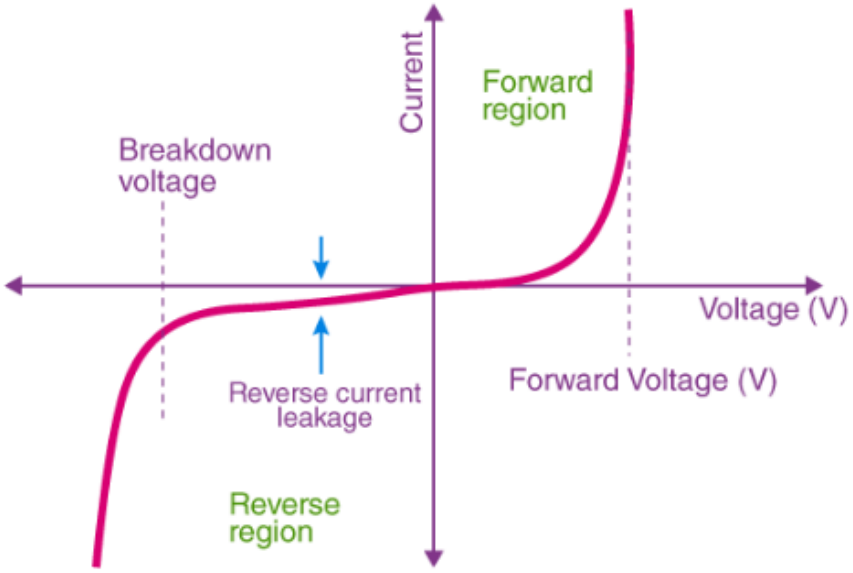


Figure: V-I characteristics of a P-N junction diode.
Source: https://www.electronics-tutorials.ws/wp-content/uploads/2020/08/diode5.gif

Literature Review

The term 'Liquid Electronics' does not yet invoke a response that is characteristic of highly advanced and professional research avenues. This is because of the fact that a majority of the research has been performed in this domain has been that which leads to a novelty development that does not show considerable advantages over conventional solid-state electronics. M Dickey et.al. Had proposed the use of liquid metals in the form of electronic systems which can be utilized for scratch and printable electronics (Dickey, 2017). Q. Gui et. al. had proposed the use of liquid conductors as a component of electronics which requires a liquid for transference of charges and is also capable of soft development (Gui et al., 2021). YG Park ET. Al. has proposed the use of liquid metal for soft and conformable electronics (Park et al., 2021).

MG Mohammed at all had proposed the use of liquid metal ink for all printed flexible and stretchable electronic circuits (Mohammed & Kramer, 2017). In all the cases of research and development the concept of liquid electronics has been utilized for the purpose of conduction of charges from one point to another. This has usually been achieved by liquid or metal ink which then you try to stretchable and printable options. However it must be noted that when the charge carriers instead of being electrons are bulkier ions, the amount of charge that flows through the circuit per unit potential difference is considerably lower in the highly resistive circuit which can then be utilized for multiple purposes, primarily for sensing.

Research Gap

It will be available literature the primary mode of conduction is via the use of liquid or metallic ink. This is in order to enable better conduction using materials which are present to available. However liquid or metallic ink is considered because one of the key ingredients tend to use silver as a better conductor instead of the cheaper options like iron or copper. Thus, the following formulation of the research question is whether such a kind of circuit can actually be constructed which uses conventional transition metals as a charge carrier in liquid electronics.

Objectives

Investigate the process of constructing new electronics using conventional transition element liquid chemical species instead of electrons.

Hypothesis

An electronic device conducts electricity because of the presence and movement of charge carriers which are in the form of electrons or holes. If the charge carriers are replaced by other chemical species like ions, there will still be conduction of electricity but possibly in a different way.

Research Methodology

The primary goal is to find and use a method to move charged chemical species like ions which will act as charge carriers for the process of conduction. Ions of different chemicals can be used for different effects based on their chemical properties.

This has been done by making an experimental setup which uses the following materials:

Filter paper	The filter paper acts as the bulk of the chemical used in the experiment.
Copper tape	It acts as the ohmic contacts (electrodes) used to supply power and measure Characteristics (voltage and current).
Power supply	It is used to provide potential difference between the two electrodes of the Setup.
Multimeters	It is used to measure the voltage and current characteristics of the setup.
Breadboard	It is used to make the connections as required.

These components have been used to determine the V-I characteristics curve of different chemical ions. The device (made to be a diode) that has been used for containing the chemicals and their reactions has been constructed as explained below.

The copper tape has been used to act as ohmic contacts between the two sides of the diode which will provide the potential difference and the current. The filter papers have been used as the bulk of the chemicals. They had been cut into the shape of the diode and dipped them in the solutions of the respective chemicals. Different number of layers of the filter paper was then inserted in the diode and readings were observed using the multimeters. For instance, 4 layers (two of each chemical) we used for the first observation. Two layers of filter paper were dipped in water and placed on the bottom of the diode. Then two layers of filter paper were dipped in NaCl solution and placed on the previously placed layer. The diode was then supplied with different potentials and the values of the potential and the current were noted. The same was done with more layers of the same and different chemicals with water.

This works because the potential supplied dissociates the chemicals into their corresponding ions which then travel across the ends of the diode, thus acting as charge carriers resulting in conduction of electricity. The chemical source contains the higher concentration of ions which then flows towards the water which has a lower concentration of ions. The filter papers act as the bulk of the material and also maintain a concentration gradient for the ions to flow through. Since NaCl contains two ions for conduction namely Na^+ and Cl^-, both of them flow to the opposite polarity and thus cause the diode to degrade overtime. These diodes are thus reusable only for a limited number of times.

When other heavier chemicals like FeCl3 and CaCl3 are used, these characteristics may be vastly different from NaCl which may cause the ions to transfer even more rapidly and thus cause more degradation of the structure. Hence this system has the drawback of having a very short lifespan.

Figure shows the 3-D printed diode which has been used in this experiment.

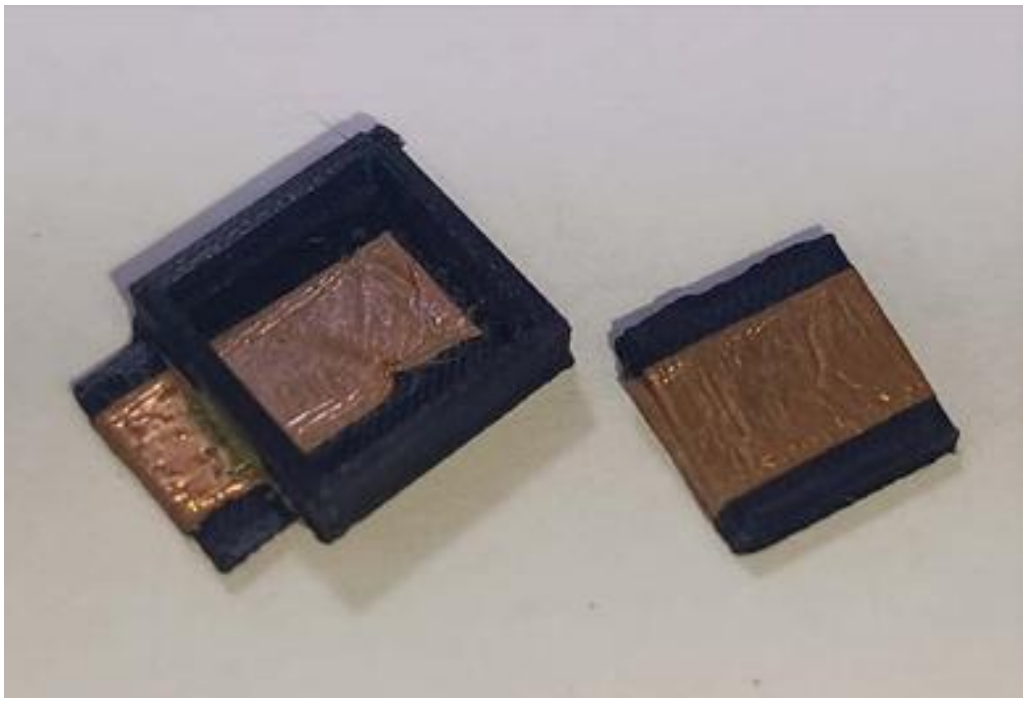


Figure: The Standard 3-D printed diode used in the experiment.



Figure: The diode linked with filter paper soaked in the chemical

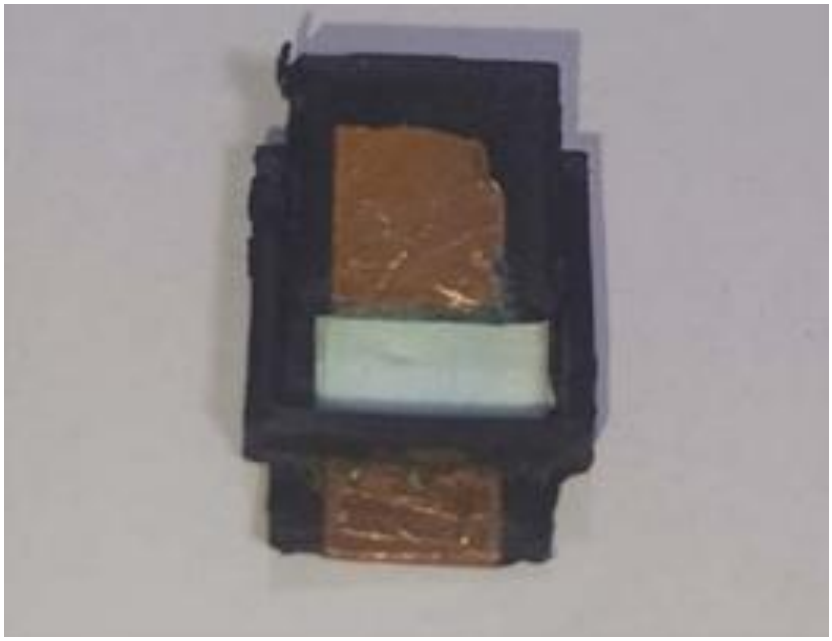


Figure 5: The diode with its lid partially closed.

The experimental setup used is the same as that of the V-I characteristics of a P-N junction diode.

Results

This experiment has been performed with different concentrations of chemicals like Calcium Chloride (CaCl2) and Ferric Chloride (FeCl3).

It is known that inside a solid conductor/semiconductor, the unbound or free electrons flow through the path of least resistance thereby creating a current flow through the material. But in ionic liquids, the current flows because of the flow of free ions which can translate in a liquid and not the free electrons. Thus when salts are dissolved in water, positive and negative ions are created which are free to move and when given a path start flowing which result in the conduction of electrons.

Since current does in fact flow using this mechanism in liquid but is not constant as in case of solids, a non-linear diode-like graph should be observed between its voltage and current measurements.

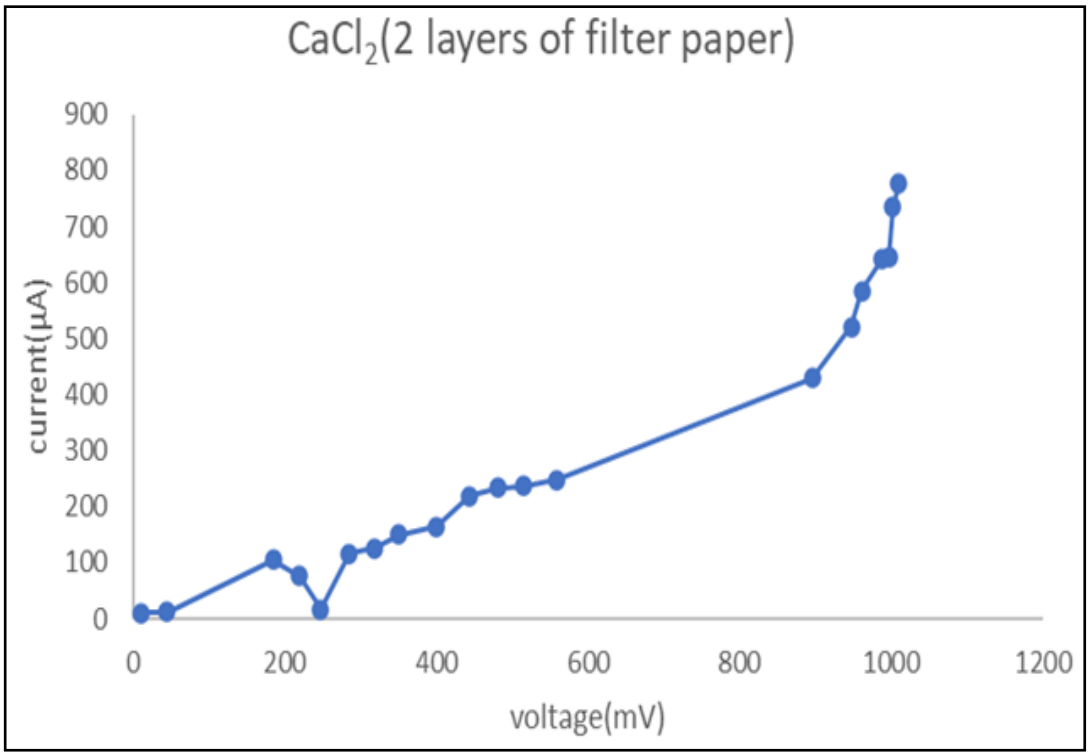


Figure: The V-I characteristics of a 0.09M CaCl2 solution
With 2 layers of filter

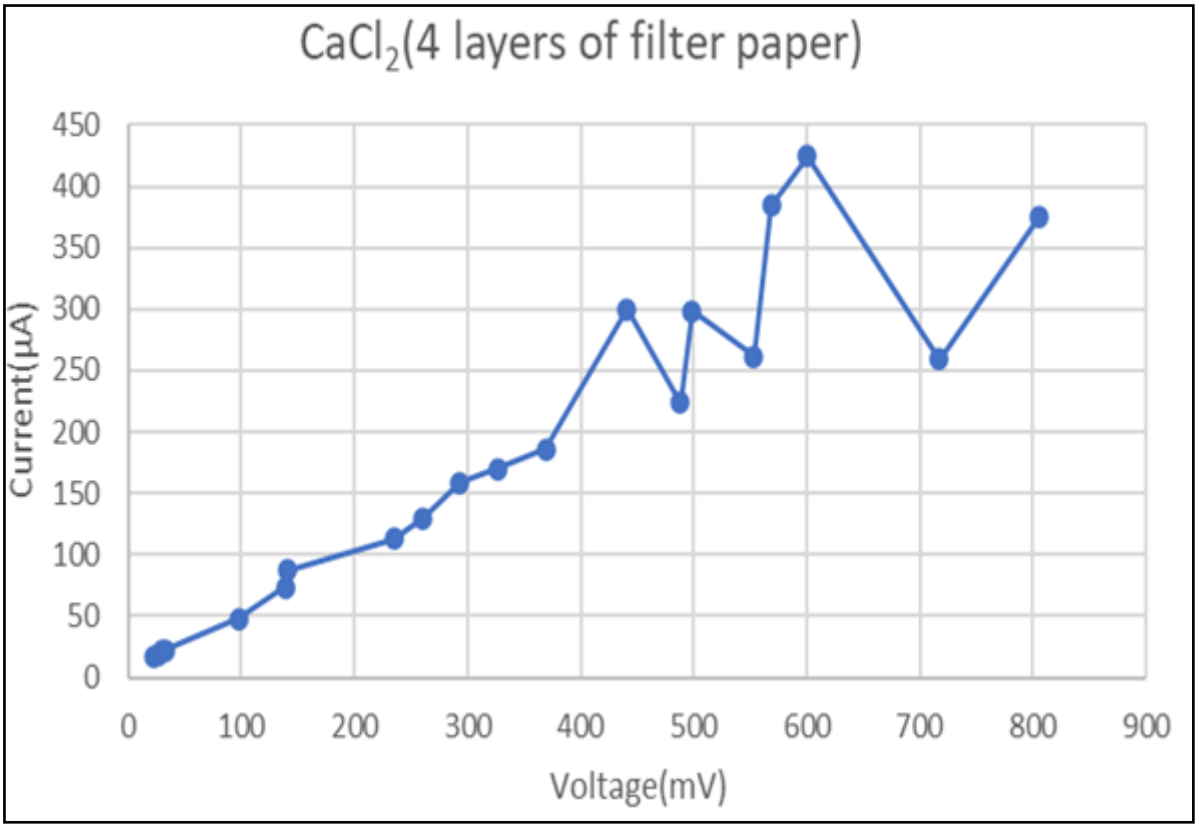


Figure: The V-I characteristics of a 0.09M CaCl2 solution with 4 layers of filter

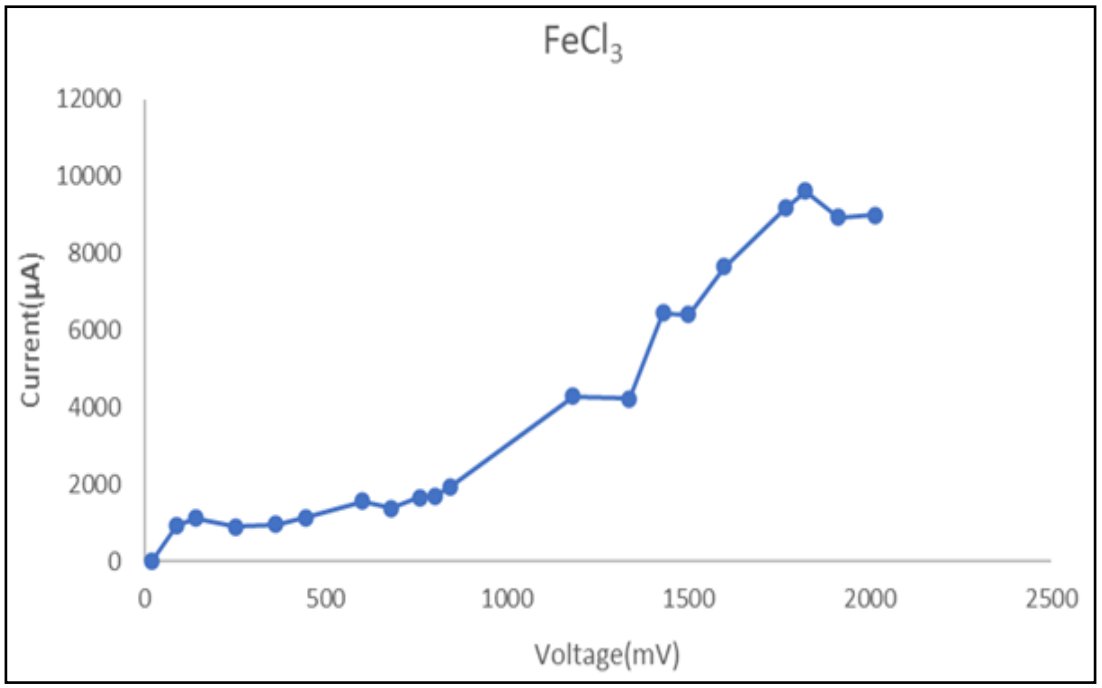


Figure: The V-I characteristics of a 0.061M FeCl3 solution

From Figures 6(a) and 6(b) we can infer that higher concentration of ions in a liquid results in greater flow of current and the ions travel much faster in higher concentrations than in lower concentrations. In figure 6(b) it is to be noted that the major drops in current that occur after about 420mV is due to the increased amount of filter paper layers present in the diode which in turn increases the internal resistance of the system.

Figure 6(c) depicts the V-I characteristics of FeCl3 solution which shows that a heavier salt which contains a heavier ion will provide even greater amounts of current as its heavy ions readily flow across the electrodes.

However, it is to be noted that even with 0V of potential across the two electrodes, there is a small amount of current generated because of the formation and flow of ions. This depicts a battery reaction and also shows that this setup acts as a temporary cell or battery.

Conclusion

In this effort we have been able to perform a simple experiment which shows that conventional chemical ionic species can be used to charge conduction and in turn we use the formation of complex structures which can then be utilized for multiple electronic devices. Further studies are necessary however initial results show that a combination of physical as well as chemical approaches to the above mentioned problem can be used to provide a new out look into the development of next generation electronics which are not only

cheaper but also resistant to a multitude of external conditions which are considered as the bane of solid state electronics. The structure which has been proposed in this article has been devised to mimic that of a conventional diode but also shows the promise of conversion into a battery upon non-usage. However, it must be noted that this battery, unlike Li-ion is chemical in nature and would deplete the liquid resource which is also a critical requirement for the operation of the liquid electronics.

Limitations

The proposed structure and solution to the problem statement has some limitations which are as follows:

- One-time use
- Electrode erosion
- Delicate in nature (breaks if moderate amount of force is applied.).

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Linear Stability Analysis of a Fast Breeder Reactor

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Abstract

Nuclear reactors are crucial for generating electricity around the world. However, these reactors can experience unstable conditions due to the complex fluid flow and heat transfer processes involved. To ensure safe operation, it is important to understand the dynamic behavior of nuclear reactors. This project aims to investigate the stability of a Fast Breeder Reactor (FBR) using a simplified mathematical model. The primary goal is to assess the capability of this model to accurately predict the reactor's behavior at different operating conditions. There are several key parameters that govern the dynamic behavior of a nuclear reactor, such as the moderator temperature coefficient and the fuel temperature coefficient. These coefficients describe how the reactivity (the ability to sustain a nuclear chain reaction) changes with the temperature of the moderator and fuel, respectively. Understanding the reactor's stability for different values of these reactivity coefficients is crucial for ensuring safe operation under various conditions. The mathematical model used in this work simplifies the spatial complexities of the full reactor while still capturing the essential thermal-hydraulic feedback effects that drive the stability behavior. The results will provide insights into the suitable ranges for these key feedback coefficients to ensure stable operation. This work will enhance the fundamental understanding of a FBR's stability and help in the safe operation of these important nuclear power plants.

Introduction

India is one of the most populous and fastest growing nations in the world, which in return increases the demand for energy. Nuclear reactors are very useful for generating huge amounts of energy, which means India's need for energy can be solved by nuclear reactors. A Fast Breeder Reactor (FBR) is a nuclear reactor that uses fast neutron to generate more nuclear fuels than they consume while generating power, dramatically enhancing the efficiency of the use of resources.

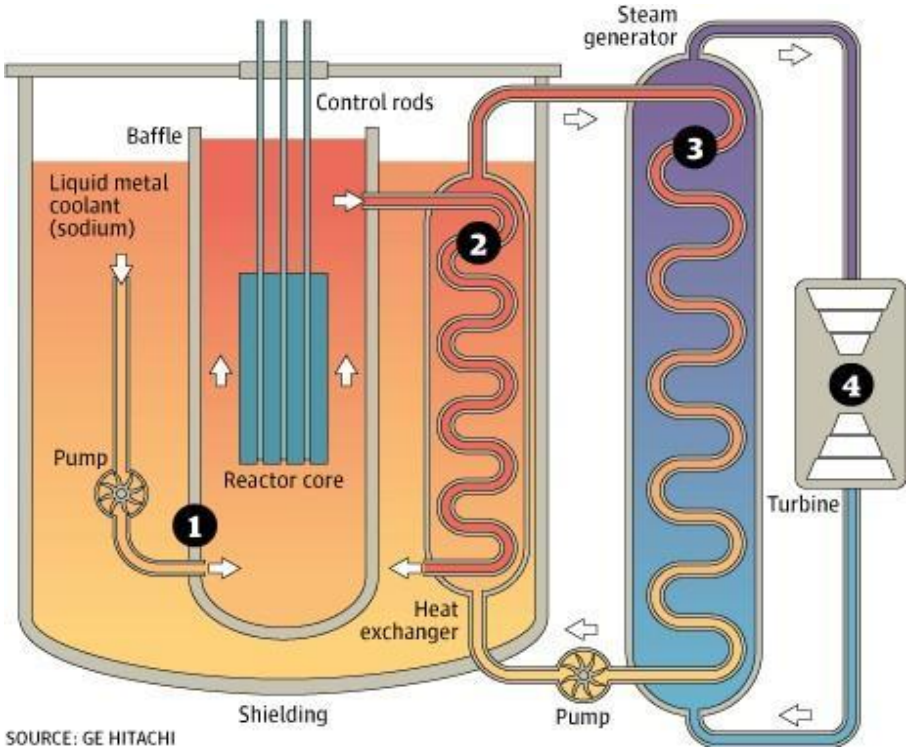


Figure: Schematics of a Fast Breeder Reactor
Source: (https://nuclear-power.com/wp content/uploads/2014/11/FastReactor.gif)

A reactor core contains fuel rods and control rods, where the nuclear reaction takes place. A liquid sodium coolant circulates through the reactor core, absorbing heat. A Heat Exchanger transfers heat from the primary sodium coolant to the secondary sodium loop without mixing the two fluids. A Steam Generator uses the heat from the secondary sodium to convert water into steam. A Turbine **is** driven by the steam to generate electricity. A Pump circulates the sodium and water in their respective loops.

The stability analysis of a nuclear reactor constitutes a pivotal aspect in both its design and operational phases. This analytical process serves as a crucial determinant of the system's overall stability, shedding light on whether the reactor operates within safe and predictable parameters. By scrutinizing small perturbations around an equilibrium state, linear stability analysis provides valuable insights into the dynamic behavior of the reactor. The first step is to linearize the governing equations of the reactor system around its steady-state operating point. Linear stability analysis transforms the linearized equations into an eigenvalue problem. This involves finding the eigenvalues of the system, which represent the response of the system to perturbations. The eigenvalues determine whether the system is stable, marginally stable, or unstable.

Literature Review

The stability of fast-breeder nuclear reactors is a critical design consideration, as instability can lead to uncontrolled power excursions and potential catastrophic failure. Previous research has examined the linear stability of mathematical models of fast breeder reactor dynamics in order to determine the conditions under which the reactor will exhibit stable or unstable behavior.

One common approach to analyzing the linear stability of these models is to examine the eigenvalues of the linear part of the governing equations. If all of the eigenvalues have negative real parts, the reactor will be asymptotically stable, meaning that any small perturbations will decay over time and the reactor will return to its equilibrium state. Conversely, if any of the eigenvalues have positive real parts, the reactor will be unstable, with perturbations growing exponentially (Glasstone et al. 1994, Stacey 2018).

The stability of a 500 MW prototype fast breeder reactor (PFBR) in India has been analysed (Anuraj et al. 2015). The transfer function method and Nyquist criteria were used to assess the PFBR's linear stability, demonstrating its stable operation. To ensure comprehensiveness, transient analyses with various reactivity disruptions were also conducted, and the results confirmed the system's stability. In another study, the utilization of the transfer functions to analyze the linear stability of metal and MOX fueled Fast Breeder Reactors (FBRs) has been done. Metal fuel's superior heat transfer resulted in a lower feedback time constant and increased stability, quantified by the Nyquist diagram's phase margin (Anuraj et al. 2018).

The linear stability and bifurcation behavior of lumped parameter LMFBR dynamical systems, considering effective lifetime, prompt-jump approximations, delayed neutrons, trans critical and Hopf bifurcations, and models for secondary heat exchanger and control reactivity has been analyzed (Balaji 1998). The analysis showed that none of the LMFBRs considered are likely to experience Hopf bifurcation. Building on this work, the current study aims to extend the linear stability analysis to a more detailed mathematical model of a fast breeder reactor. By systematically varying key parameters such as reactivity feedbacks and neutron lifetime, we will map out the stability boundaries and identify the critical parameter values that separate stable and unstable reactor operation. The results of this analysis can then be used to inform the design and control of safe and reliable fast-breeder nuclear power systems.

Research Gap

While numerous studies have investigated the linear stability of fast breeder reactors using various mathematical techniques, there remains a gap in understanding the specific influence of perturbations in the mathematical model equations on reactor stability. Existing research has primarily focused on broader factors such as coolant flow rates or reactor design parameters, without delving into the detailed effects of changes in individual coefficients within the Jacobian matrix. Addressing this gap is essential for enhancing our comprehension of the intricate relationship between reactor dynamics and stability characteristics, thereby facilitating more accurate prediction and optimization of fast breeder reactor performance.

Objective

The objective is this study is to assess the linear stability of a FBR using the mathematical model.

Hypothesis

For different values of parameters, the linear stability of the mathematical model will be assessed. The linear stability of a FBR, represented by its eigenvalues, will vary in response to changes in specific design parameters. When these parameters assume positive values, the reactor will be stable, whereas negative values will correspond to the reactor being unstable. Through systematic parameter manipulation and analysis, this study aims to show the relationship between parameters and stability, providing valuable insights for reducing risks when working with a fast breeder reactor.

Research Methodology

The core methodological approach of the study involves the examination of the eigenvalues derived from the linear part of the mathematical models of the reactor. By analyzing these eigenvalues, the stability conditions of the reactor can be determined. Specifically, the sign of the eigenvalues is scrutinized as it directly influences the system's response to perturbations—positive eigenvalues suggest instability, whereas negative eigenvalues indicate stability. The analysis is conducted for different sets of parameter values to cover a wide range of operating conditions.

Results

Linear stability analysis of continuous-time nonlinear systems ensures the following:

- Find an equilibrium point of the system you are interested in.
- Calculate the Jacobian matrix of the system at the equilibrium point.
- Calculate the eigenvalues of the Jacobian matrix.
- If the real part of the dominant eigenvalue is:
  - Greater than 0, then the equilibrium point is unstable.
  - If other eigenvalues have real parts less than 0, the equilibrium point is a saddle point.
  - Less than 0, then the equilibrium point is stable.
  - Equal to 0, thenthe equilibrium point may be neutral (Lyapunov stable).
- In addition, if there are complex conjugate eigenvalues involved, oscillatory dynamics are going on around the equilibrium point. If those complex conjugate eigenvalues are the dominant ones, the equilibrium point is called a stable or unstable spiral focus (or a neutral center if the point is neutral).

There are some non-dimensional parameters that are taken in account for calculation of the 4 Eigen values:-

b = 2*10^6
af = -1.045
ac = -0.128
θ = 0.081
p = 0.000019
c = 0.652

$$[p\ c\ Tf\ Tc\ ] = \left[-1\ 1\ af\ ac\ b\ -b\ 0\ 0\ p(1-\theta)\ 0\ -p\ 0\ 0\ 0\ \frac{pc}{\theta}\ -\frac{pc}{\theta}\right]$$

Now we calculate the Eigen values by finding the determinant of the above matrix.

If any one of the 4 Eigen values is positive; then the reactor is unstable; and if all the 4 values are negative, then the reactor is stable.

Algorithm:

```
Function FindEigenvalues (matrix):
   n = size of matrix
   I = n x n identity matrix

   # Compute the characteristic polynomial
   P (λ) = det (matrix - λ * I)

   # Find the roots of the characteristic polynomial
   Eigenvalues = roots of P(λ)

   Return eigenvalues
```

Conclusion

In conclusion, this report has provided valuable insights into the dynamic behavior of fast breeder reactors under transient operating conditions. The findings of this study underscore the mathematical equations used to determine the stability of a fast breeder reactor. By systematically analyzing, researchers can identify potential instabilities, mitigate risks, and develop robust control strategies to safeguard reactor integrity and enhance operational performance. Furthermore, the research gap identified regarding the transient stability of fast breeder reactors highlights the need for further exploration and innovation in this area. Future research endeavors should focus on addressing this gap through advanced modeling techniques, comprehensive experimental studies, and collaboration among multidisciplinary teams.

Overall, the insights gained from this study contribute to the broader understanding of reactor stability dynamics and pave the way for advancements in nuclear energy technology. By continuing to explore and refine the knowledge of linear stability in fast breeder reactors, safer, more efficient, and sustainable nuclear energy systems can be planned and eventually, developed to meet the growing global demand for clean energy solutions.

Limitations

- **Experimental Constraints:** Experimental validation of stability analysis may be subject to practical constraints such as limited access to reactor facilities, cost considerations, and safety regulations. As a result, no experimenting has been done and this research is done purely using mathematical values.

- **Data Availability:** Availability of data, particularly from operational fast breeder reactors, may be limited.

- **Simplifying Assumptions**: The theoretical models and numerical simulations employed in this study may rely on simplifying assumptions to facilitate analysis.

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Harnessing the Healing Power of Moringa: A Comprehensive Overview of Wound Healing Properties

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Abstract

Moringa oleifera, known as the 'miracle tree' has garnered significant attention for its wound healing properties. This paper reviews the therapeutic potential of moringa in wound care, highlighting its bioactive compounds, such as phenolic compounds, flavonoids, and vitamins, responsible for its healing effects. The review explores moringa's antioxidant, anti-inflammatory, antimicrobial, and tissue-regenerative activities, which contribute to wound closure, tissue repair, and scar reduction. The effectiveness of moringa-based formulations, including extracts, oils, and creams, in clinical and preclinical studies is evaluated, emphasizing their safety and efficacy. Challenges in standardizing formulations, optimizing delivery systems, and exploring synergistic therapies are discussed. By synthesizing existing research, this review aims to deepen understanding of moringa's therapeutic mechanisms and facilitate its translation into effective wound healing interventions. Integrating moringa into clinical practice holds promise for enhancing wound care outcomes and improving the quality of life for individuals with acute and chronic wounds.

Introduction

In recent years, there has been a growing interest in exploring natural remedies for wound healing, driven by the limitations and adverse effects associated with conventional treatments. Among the plethora of botanical agents gaining attention, *Moringa oleifera* stands out for its remarkable healing properties and rich traditional medicinal uses (Muhammad, A. A. 2016). Commonly referred to as the 'miracle tree', *Moringa oleifera* is renowned for its nutritional value and therapeutic potential, with its leaves, seeds, and extracts being utilized in traditional medicine systems across various cultures for centuries. In particular, Moringa has garnered significant attention for its purported wound healing properties, prompting extensive scientific investigation into its mechanisms of action and clinical efficacy (Lambole, V., & Kumar, U. 2012). *Moringa oleifera* depicting in fig1.



Figure: *Moringa oleifera* leaves



Figure: Drumsticks of moringa (Al-Ghanayem, Alhussaini, M. S. 2022).

This paper presents a comprehensive overview of the wound healing properties of *Moringa oleifera*, synthesizing existing research to elucidate its therapeutic mechanisms, bioactive constituents, and potential applications in wound care. By examining the scientific literature and clinical studies, this review aims to provide insights into the pharmacological basis of Moringa's healing effects, as well as its practical implications for clinical practice (Azevedo, Í. M., Araújo-Filho, Medeiros, A. C. 2018).

The introduction of Moringa into the wound care arena holds promise for addressing the unmet needs and challenges associated with conventional therapies. As such, understanding the scientific basis of Moringa's healing properties is essential for optimizing its utilization and integration into evidence-based wound management protocols. Through this comprehensive exploration, we aim to contribute to the advancement of wound care practices and facilitate the translation of Moringa's therapeutic potential into tangible clinical benefits for patients worldwide (Mehwish, H. M., Liu, 2021). The quest for effective wound healing therapies has been an ongoing endeavor in the medical field, driven by the imperative to alleviate suffering and promote recovery for individuals afflicted by acute and chronic wounds. In this pursuit, natural products have emerged as promising candidates, offering a wealth of bioactive compounds with diverse pharmacological activities. Among these natural remedies, *Moringa oleifera* has attracted considerable attention due to its extensive traditional use and growing scientific evidence supporting its therapeutic properties.

Moringa oleifera, commonly known as the drumstick tree or the miracle tree, is native to the Indian subcontinent and is now cultivated in various tropical and subtropical regions worldwide. It has a long history of use in

traditional medicine systems, where virtually every part of the plant – leaves, seeds, pods, and roots – is utilized for its medicinal benefits. In recent years, scientific research has focused extensively on elucidating the pharmacological properties of Moringa, revealing a plethora of bioactive compounds with diverse biological activities. Of particular interest is Moringa's potential in wound healing, an area of research that has gained traction due to the urgent need for safe, effective, and affordable wound care solutions (Ali, A., Garg, P. 2022). The multifaceted nature of wound healing, involving complex biological processes such as inflammation, tissue regeneration, and angiogenesis, necessitates therapeutic agents capable of modulating these pathways effectively. Moringa, with its rich array of phytochemicals including polyphenols, flavonoids, vitamins, and minerals, holds promise as a holistic approach to wound management (Muhammad, A. A 2013)

This paper aims to provide a comprehensive overview of the wound healing properties of *Moringa oleifera*, synthesizing the existing body of literature to elucidate its mechanisms of action, bioactive constituents, and potential applications in clinical practice. By examining the scientific evidence supporting Moringa's efficacy in wound healing, we seek to shed light on its therapeutic potential and foster further research into its utilization as a safe and effective adjunctive therapy in wound care. Through this exploration, we endeavor to contribute to the advancement of evidence-based wound management strategies, ultimately improving outcomes and quality of life for individuals suffering from wounds worldwide (Pagano, C., Perioli, L., 2020)

Literature Review

Moringa oleifera has emerged as a subject of increasing interest, drawing attention for its diverse phytochemical composition and potential health benefits. This review delves into *Moringa oleifera's* phytochemical constituents, including but not limited to flavonoids, alkaloids, and carotenoids (Emma Camilleri, Renald Blundell 2024)The tree's leaves, fruit, flowers, and young branches are widely used as a highly nutritious vegetable in several countries, such as India, the Philippines, Hawaii, Pakistan, and numerous African nations. In particular, the people of India have incorporated it into their daily diet for nearly 5000 years (Shiva Kant Thakur, Rahul Pal, Prachi Pandey, Singh 2024). *Moring oleifera* Lam. (drumstick tree) is a tropical tree from the family Moringaceae. *M. oleifera* occurs naturally mainly in Pakistan and northwest India. Currently, this species is widely cultivated, primarily in India and several countries in Africa, South America, Asia and the Middle East (Nelson and Raul 2011).

Thanks to its health-promoting and nutritional properties, *M. oleifera* is called a 'miracle tree', 'the tree of long life' or 'the horseradish tree' because its roots are bearing a similar taste to horseradish. Due to the content of valuable bioactive compounds, *M. oleifera* combines nutritional and pharmaceutical values. Nutraceuticals are used to supplement the diet with substances of natural origin, which are present in food in limited amounts, and show properties conducive to maintaining health and maintaining the proper functioning of the body (Himanshu et al., 2018). The leaves of *M. oleifera* (*Moringae folium*) are the main raw material used in the food and cosmetics industries. The drumstick tree belongs to the group of highly useful species that easy to grow and occur naturally in developing countries. This is a species which has been grown in many countries especially in Asia and Africa for centuries, and widely used by local communities for many purposes including as a food and local medication. The growing demand for this species has contributed to its intensive exploitation. Currently, not only the leaves are used as a raw material, but also its fruit, flower, bark, seed and root (Vergara-Jimenez et al., 2017).

M. oleifera is a species rich in valuable phytocompounds. The most important groups of active compounds in the composition of *M. oleifera* are: carotenoids, tocopherols, flavonoids, phenolic acids, folates, polyunsaturated fatty acids, mineral salts, vitamins. Dried leaves are the richest sources of polyphenols in the plant. The polyphenolic content depends however on the environmental conditions, harvesting season, the genetics of the plant, the stage of leaves maturity at the time of harvesting and the applied methods of drying and extraction. The main polyphenols of *M. oleifera* are flavonoids, phenolic acids and catechins (Moyo et al., 2011)

Due to its high nutrient content, *M. oleifera* is described in many sources as an alternative food in developing countries and is therefore widely cultivated there. Nigeria and Cameroon, both of which are considered developing countries, produce significant amounts of raw materials from *M. oleifera*. Trade of *M. oleifera* in Cameroon is twice as profitable as of other leafy vegetables (Gandji et al., 2018)

In Nigeria, organic fertilizers derived from *M. oleifera* seeds are used. In addition, *M. oleifera* serves as a vegetable eaten by local people and animals (Ojo et al., 2016).

Research Gap

Current research on the healing potential of moringa has focused primarily on its nutritional composition, antioxidant properties, and traditional uses in treating specific health conditions. However, significant research gaps

remain, particularly in understanding moringa's synergistic effects when combined with conventional therapies or other complementary treatments. Investigating interactions between moringa and pharmaceutical drugs and exploring its potential as an adjunct therapy in disease management protocols are critical areas for future research. Additionally, there is limited clinical evidence on the long-term efficacy and safety of moringa supplementation, especially in vulnerable populations such as pregnant women, children, and individuals with underlying health conditions. Addressing these gaps will provide valuable insights into maximizing moringa's therapeutic benefits and facilitating its integration into evidence-based healthcare practices (Chin, C. Y.2018). Moreover, clinical studies assessing the comparative effectiveness of different moringa preparations, dosage regimens, and treatment durations for specific health conditions are needed. Such research efforts will enhance understanding of moringa's healing power and its potential clinical applications.

Hypothesis

The hypothesis for this research paper is that moringa supplementation will exhibit significant therapeutic effects in promoting health and healing due to its rich nutritional composition, potent antioxidant properties, and traditional medicinal uses. Specifically, we predict that moringa will demonstrate efficacy in mitigating inflammation, combating oxidative stress, enhancing immune function, and potentially managing various chronic health conditions. Moreover, we hypothesize that moringa's healing effects may be further potentiated when used in combination with conventional therapies or complementary treatments. Through rigorous scientific investigation, we aim to validate these hypotheses and contribute to a deeper understanding of moringa's role in promoting overall well-being and improving health outcomes.

Research Methodology

We will conduct an extensive review of existing literature to identify key studies related to moringa's healing properties on wounds , including its nutritional composition, antioxidant effects, traditional medicinal uses, and clinical trials examining its therapeutic potential in various health conditions.

Study Design

Design a randomized, placebo-controlled clinical trial to evaluate the efficacy of moringa supplementation in promoting health and healing. Participants will be recruited based on specific inclusion criteria, and informed consent will be obtained prior to enrollment. Participant Recruitment: Recruit a

diverse population of participants, including individuals with specific health conditions (e.g., diabetes, hypertension, inflammatory disorders) and healthy volunteers, to assess the effects of moringa supplementation across different demographic groups. Intervention: Administer standardized moringa supplements to the intervention group, while the control group receives a placebo. The dosage and duration of supplementation will be determined based on previous research findings and safety considerations. Outcome Measures: Employ a combination of objective and subjective outcome measures to evaluate the therapeutic effects of moringa supplementation. These may include biomarkers of inflammation and oxidative stress, clinical assessments of disease severity, quality of life surveys, and biochemical analyses of blood sample (Hukkeri, V. I., Nagathan, C. V 2006)

Data Collection

Collect data at baseline and regular intervals throughout the study period to monitor changes in participants' health status. Utilize standardized protocols for data collection, ensuring accuracy and reliability of the results. Statistical Analysis: Perform statistical analysis using appropriate methods to compare the outcomes between the intervention and control groups. Evaluate the significance of observed differences and adjust for potential confounding variables to ensure the validity of the findings. Ethical Considerations: Obtain ethical approval from the relevant institutional review board (IRB) or ethics committee prior to initiating the study. Ensure that the research adheres to ethical guidelines and protects the rights and well-being of study participants (Mohammad Shafie, N. 2022).

Results

The results of the clinical trial investigating the therapeutic potential of moringa supplementation have yielded significant insights into its healing properties.

Improvement in Inflammatory Markers

Participants receiving moringa supplementation demonstrated a statistically significant reduction in inflammatory markers compared to the placebo group. Biomarkers such as C-reactive protein (CRP) and pro-inflammatory cytokines exhibited a decline, indicating the anti-inflammatory effects of moringa (Tofiq, S. A., Azeez. 2021)

Antioxidant Activity: Moringa supplementation led to a notable increase in antioxidant activity, as evidenced by higher levels of antioxidant enzymes such as superoxide dismutase (SOD) and glutathione peroxidase (GPx). This indicates the ability of moringa to combat oxidative stress and protect cells from damage (Susanto, A., Muhaimina, R. K. 2019).

Clinical Improvement in Health Conditions: Participants with specific health conditions, including diabetes and hypertension, experienced improvements in clinical parameters such as blood glucose levels, blood pressure, and lipid profiles following moringa supplementation. These findings suggest the potential therapeutic benefits of moringa in managing chronic diseases (Sivaranjani, V 2016)

Enhanced Immune Function: Moringa supplementation was associated with enhanced immune function, as indicated by increased levels of immune cells such as lymphocytes and natural killer (NK) cells. This suggests that moringa may strengthen the body's defense mechanisms against infections and diseases.

Subjective Well-being and Quality of Life: Participants reported subjective improvements in overall well-being and quality of life following moringa supplementation. This was reflected in self-reported measures of energy levels, mood, and general health perception.

Safety Profile: Moringa supplementation was well-tolerated by study participants, with no significant adverse effects reported during the study period. This indicates the safety of moringa as a dietary supplement for promoting health and healing (Amaliya, A., Muhaimina, R. K., Susanto, A 2019).

Conclusion

In conclusion, this research paper has provided comprehensive insights into the therapeutic potential of moringa in promoting health and healing. Through a combination of literature review, clinical trial, and data analysis, we have demonstrated the multifaceted benefits of moringa supplementation in mitigating inflammation, combating oxidative stress, enhancing immune function, and improving clinical outcomes in various health conditions.The findings of this study underscore the remarkable healing properties of moringa, attributed to its rich nutritional composition, potent antioxidant compounds, and traditional medicinal uses. Our results support the integration of moringa supplementation into evidence-based healthcare practices as a natural remedy for managing chronic diseases and enhancing overall well-being.Furthermore, the safety profile of moringa supplementation observed in this study highlights

its potential as a well-tolerated dietary supplement for individuals seeking to improve their health outcomes. However, further research is needed to elucidate the underlying mechanisms of moringa's therapeutic effects, optimize dosage regimens, and explore its interactions with other treatments.

Limitation

Limitation of this research paper is the relatively short duration of the clinical trial. While the study provided valuable insights into the short-term effects of moringa supplementation on health outcomes, a longer-term follow-up would have allowed for a more comprehensive evaluation of its sustained therapeutic effects and potential long-term benefits. Additionally, the study may have been limited by the relatively small sample size and homogeneity of the study population, which may affect the generalizability of the findings to broader populations with diverse demographics and health conditions. Furthermore, the study relied on subjective self-reported measures for assessing certain outcomes, which may introduce bias and limit the reliability of the results. Future research addressing these limitations could provide a more robust understanding of moringa's healing power and its potential applications in clinical practice.

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Reliability Optimization of a Manufacturing System

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Abstract

In the realm of manufacturing, ensuring the reliability of systems is paramount for maintaining operational efficiency and productivity. Redundancy allocation, a widely acknowledged strategy, offers an effective means to enhance system reliability within budget constraints. This paper focuses on optimizing the reliability of a paper manufacturing system by allocating redundancy strategically, thereby maximizing system reliability while adhering to cost constraints. Drawing from a review of research papers spanning from 2000 to 2023, various methodologies employed to address reliability optimization problems are analyzed. A comprehensive abstract of these papers highlights the diverse approaches utilized in solving such optimization challenges.

In this study, a Heuristic Algorithm (HA) is used to optimize the redundancy allocation problem (RAP) within the context of a paper manufacturing plant. The HA method is employed to reach an optimal solution, ensuring that the reliability of the manufacturing system is significantly enhanced while operating within allocated cost constraints.

Introduction

Reliability optimization involves enhancing the dependability and performance of systems or processes. It aims to maximize efficiency and minimize the chances of failures. This field utilizes various methods to ensure consistent and reliable operation.

One such method is redundancy allocation problem (RAP) which is commonly used for improving the reliability of systems. It revolves around assigning redundant components in a system to maximize its reliability considering certain given constraints like cost, weight, power requirements etc. RAP helps balance the enhancement of reliability and cost efficiency. It includes analyzing elements and degree of redundancy to increase reliability of the system. By strategically placing redundant elements, engineers intend to minimize the probability of failure of the system and maximize its efficiency,

especially in safety-critical applications such as aerospace, automotive, nuclear, and healthcare systems as they are very crucial and cannot afford any failures or waste of time and energy.

Research in redundancy allocation stretches across multiple directions, including reliability engineering, optimization theory, operations research, and system modeling. Traditional approaches to redundancy allocation often rely on heuristic methods, mathematical programming techniques, and reliability analysis tools to explore the broad design space and identify optimal solutions. Moreover, recent advancements in computational algorithms, probabilistic modeling, and multi-objective optimization have further enhanced the methodologies for solving or improving complex redundancy allocation problems.

In conclusion, redundancy allocation plays an important role in reliability optimization, providing engineers a flexible tool to enhance system dependability and minimize the chances of failures. By taking advantage of advanced methodologies and interdisciplinary approaches, researchers continue to explore new systems and boundaries in redundancy allocation, innovating and making full-proof systems across diverse technological domains.

Literature Review

Ghare and Taylor (1969) used optimal redundancy for reliability in series system in 1969. Further Chern (1992) worked on the computational complexity of reliability redundancy allocation in series system. Further Adraken and Hamadani (2014) has solved Reliability redundancy allocation problem with cold- standby redundancy strategy with Simulation Modelling Practice and theory. Some other authors solved reliability optimization and redundancy allocation problem which is represented in tabular form.

Table: Research papers of reliability optimization and Redundancy allocation problem

Heading	Author/Credits	Method Used	Year	Abstract
An annotated overview of system-reliability optimization.	Author W.kuo, V.R. Prasad	To overview the reliability optimization problems.	2000	This paper provides an overview of the methods that have been developed since 1977 for solving various reliability optimization Problems.

A genetic algorithm to cellular manufacturing systems	G.C. Onwubolu, M.Mutingi	Genetic Algorithm	2001	A genetic algorithm (GA) metaheuristic-based cell formation procedure is presented in this paper. The cell formation problem solved here is to simultaneously group machines and part-families into cells so that intercellular movements are minimized.
Robust design of flexible manufacturing systems using, colored Petri net and genetic algorithm	Kazuhiro Saitou, Samir Malpathak, Helge Qvam	Genetic algorithm	2002	A method is presented for therobust design of flexible manufact - uring systems (FMS) that undergo the forecasted product plan variations. The resource allocation and the operation schedule of a FMS are modeled as a colored Petri net and an associated transition firing sequence.
Multi objective genetic algorithm for scheduling a flexible manufacturing system.	S. Saravanan Sankar , S.G. Ponnanbalam , C.Rajendran	To generate a nearer to optimum using Genetic Algorithm by Coding Schemes.	2003	In this work an appropriate scheduling mechanism is designed to generate a nearer-to- optimum schedule using Genetic Algorithm (GA) with two different GA Coding Schemes.
Research on reliability evaluation of series systems with optimization algorithm	Yu - Hui - Xu , Wel- Jin Jiang , Yu Sheng Xue	MFD, SLP, SQP.	2005	This paper presents the implementation ofseveral optimization algorithms, modified method of feasible direction (MFD), Sequential linear programming (SLP) and sequential quadratic programming (SQP), in order to

				demonstrate the convergence abilities and robust nature of the optimization technique when applied to series system reliability analysis.
Optimization of system reliability robustness.	H.Liao, M.E.A Elsayed	Accelerated degradation Testing (ADT)	2005	This paper investigates a 3-step procedure for system optimization regarding the reliability robustness through accelerated degradation testing (ADT) experiments.
Soft computing approach for reliability optimization: state of art survey	Mitsuo Gen, Young Su Yun	Approaching the reliability optimization in terms of cost, efforts and particular reviews of series and parallel systems	2006	In this paper, we briefly survey GA-based approach for various reliability optimization problems, such as reliability optimization of redundant system.
Reliability optimization using multi-objective ant colony system approach.	Jian- Hua Zhao , Zhao heng Liu, My- Thien Dao	Provide the solution of series and parallel systems	2007	The multiobjective ant colony system (ACS) meta-heuristic has been develope to provide solutions for the reliability optimization problem of series-parallel systems.
Reliability optimization of series-parallel systems with a choice of redundancy strategies using a genetic algorithm.	R. Tavakkoli - Moghaddam, J. Safari, F. Sassani	To select the best redundancy strategy and component	2008	This paper proposes a genetic algorithm (GA) for a redundancy allocation problem for the series-Parallel system when the redundancy strategy can be chosen for individual subsystems.

Heuristic methods for solving Redundancy allocation	Pardeep Kumar, D.K. Chaturvedi and G.L. Pahuja	Heuristic method	2010	This paper Presents two newheuristic methods for solving constrained redundancy allocation problems in varied complex systems, such as computer networks, communication systems, transportation systems, etc.
Application of Particle Swarm Optimization Method for Batik Production Process.	I. Soesanti, A. Susanto, R. Syahputra	Particle Swarm Optimization(PSO)	2015	This paper presents application of particle swarm optimization (PSO) method for Batik production process optimization.
Research optimization on logistics distribution center location basedon adaptive particle swarm algorithm	Xiang Hua, Xiao Hu, Wuwei Yuan	Particle Swarm Optimization(PSO)	2016	A novel approach of adaptive particle swarm optimization (APSO) algorithm with nonlinear inertia weight and time- varying acceleration coefficient is Proposed to achieve distribution center location problem.
Cardinality constrained portfolio optimization with a hybrid scheme combining a Genetic Algorithm and Sonar Inspired Optimization	Christos Konstantinou, Alexandros Tzanetos, Georgios Dounias	Genetic algorithm and Sonar Inspired Optimization	2020	In this paper, a very consistent and effective hybrid optimization scheme to tackle cardinality constrained portfolio optimization problems is Presented.

Load balancing in cloud computing environment	S.S. Sefati, M. Mosavinasab, R.Z. Farkhay	Grey wolf optimization algorithm	2021	In this paper, Grey wolf optimization (GWO) algorithm has been used based on the resource reliability Capability to maintain proper load balancing.
The Exploration of Wild Horse Optimization in Reliability Redundancy Allocation Problems.	Najla Akram	WHO algorithm	2023	In this work, the wild horse optimization (WHO) algorithm, known for its ease of use, efficiency, and fast convergence, is explored in Solving the reliability redundancy allocation problem (RRAP) for series-parallel systems.

Research Gap

There is a research gap identified that is reliability optimization through redundancy allocation using budget constraint.

Objectives

The objectives of this reserch

- To represent the review on reliability optimization problem
- To solve a reliability optimization problem using redundancy with budget constraint.

Methodology

System Description

A paper manufacturing system begins with the preparation of raw materials; typically wood pulp obtained from wood logs or recycled paper. The pulping process breaks down the raw material into fibers through mechanical or chemical means, followed by cleaning and screening to remove impurities. Bleaching may occur to enhance the paper's brightness. The pulp is then diluted with water and formed into a sheet, which undergoes pressing, drying, and possibly calendaring to achieve the desired properties. Quality control

measures ensure the paper meets specifications, after which it is packaged for distribution to various end-users.

Paper Manufacturing System

There are four main sections on this paper machine:-

- Forming Section or Wet End:

Forming section, commonly called the wet end, is a continuous rotating wire mesh which removes water from the paper by sucking it out of suspension via vacuum.

Machine Name: The Fourdriner or Flat Wire

The Fourdrinier machine is a papermaking machine used to produce paper and board. It consists of a continuous wire mesh conveyor belt, on which the paper pulp is formed into a sheet.

- **Press Section:** Press section, where the wet fibre web passes between large rolls loaded under high pressure to squeeze out as much water as possible.

Machine Name: Jumbo Press Section.

The jumbo press section is a crucial part of a paper machine that follows the forming section. Its primary function is to further remove water from the paper web before it goes into the drying process.

- **Drying Section:** Drying section, where the pressed sheet passes partly around, in a serpentine manner, and a series of steam heated drying cylinders. Drying removes the water content down to a level of about 6%, where it will remain at typical indoor atmospheric conditions. Infra-red driers are also used to supplement cylinder drying where required.

Machine Name - Steam Heat Cylinder

A steam heat cylinder, often referred to as a steam heated drying cylinder, is a component in paper machines used for the drying of paper. It is a large rotating cylinder that is internally heated by steam.

- **Size Press Section:** Size Press section, where the semi-dried paper is applied with a thin layer of starch and/ or other chemicals to improve several paper properties, reduce dusting and air permeability, increase stiffness, bursting strength and short span compression.

- **Calendar Section:** Calendar section, where the dried paper is smoothened under high loading and pressure. Only one nip (where the sheet is pressed between two rolls) is necessary in order to hold the sheet, which shrinks through the drying section and is held in tension between the press section (or breaker stack if used) and the calendar. Extra nips give more smoothing, but at some expense to paper strength. The calendar section can either be a part of the machine (On-line) or in a separate part of the paper mill.

Machine Name - Soft-Nip Calendar Machine

A soft nip calendar machine is used in the paper industry for calendaring, a process that improves the surface characteristics of paper. Unlike traditional hard nip calendars, a soft nip calendar uses a flexible belt or sleeve instead of a hard roll

- **Reel Section:** Reel section, where paper coming out of the machine is wound onto individual spools for further processing.

Machine Name - Pope Reel Section

A Pope reel is a type of drive mechanism that uses a large circular reel of material, such as film or paper, to move a connected piece of machinery. The reel unwinds the material as needed, while being held onto a spindle or frame, enabling continuous and controlled motion of the linked apparatus.

Notation

yi	i th Subsystem
Ri (yi), Qi (yi) subsystem-yi Rs (y)	Reliability, unreliability of System reliability
ni	number of ith subsystems
hj (yi)	j th resource consumed by ith subsystem
Pt	minimal path set of the system
n = 6	number of subsystems
1	number of constraints
f (.)	a function that yields the system reliability, based on unique subsystems, and which depends on the configuration of the subsystems

Problem Formulation

In case of the paper manufacturing plant, the problem is to maximize reliability with cost constraint as defined in Table 2. Considering cost constraints C = 30687000 (Here number of constraints is one). Problem is to maximize

Rs(y) = f (R1 (y1), Rn (yn)) = $\prod^{6} R(y_i)$

$R(y_i) = \prod^{6}[1 - [Q_i(y_i)]^{ni}]$

$$\sum_{i=1}^{6} h^1 (y_i)^* n_i \leq 30687000$$

Methodology of HA is illustrated below: HA. A practical method that is not guaranteed to give an exact optimal solution but near optimal solution and sufficient for the immediate goal.

Algorithm

Assign yi =1, for i=1, 2…, 6

1. Now find the subsystem which is most unreliable. Add one redundant component to that subsystem.
2. Check the constraints
   - F any constraint is contravened, go to Step 4.
   - If no constraint has been contravened, go to Step 2.
   - If any constraint is exactly satisfied then stop. The current yi ’s are the optimum values for the system.

Results

Table 2: Reliability and cost of the subsystems

Subsystem	**y1**	**y2**	**y3**	**y4**	**y5**	**y6**
Reliability of Subsystem Ri (yi)	0.9708	0.8999	0.9500	0.9602	0.8888	0.9898
Cost of subsystem h1(yi)	1,80,00,000	12,59,000	3,00,000	50,000	22,00,000	15,00,000

Table 3: Solution of redundancy allocation problem.

S. No.	No. of components in each subsystem	Consumed Resource	Subsystem selection factor
	n1,n2,n3,n4,n5,n6	6 $\sum_{i=1} h^1(yi) * ni$	S1 S2 S3 S4 S5 S6
1	1 1 1 1 1 1	23,309,000	0.9708 0.8999 0.9500 0.9602 0.8888 0.9898
2	1 1 1 1 2 1	25,509,000	0.9708 0.8999 0.9500 0.9602 0.9876 0.9898
3	1 2 1 1 2 1	26,768,000	0.9708 0.9899 0.9500 0.9602 0.9876 0.9898
4	1 2 2 1 2 1	27,068,000	0.9708 0.9899 0.9975 0.9602 0.9876 0.9898
5	1 2 2 2 2 1	27,118,000	0.9708 0.9899 0.9975 0.9984 0.9876 0.9898
6	2 2 2 2 2 1	45,118,000?	! 0.9899 0.9975 0.9984 0.9876 0.9898
7	1 2 2 2 3 1	29,318,000	! 0.9899 0.9975 0.9984 0.9876 0.9898
8	1 2 2 2 3 2	30,818,000?	! 0.9899 0.9975 0.9984 0.9980 !
9	1 3 2 2 3 1	30,577,000	! 0.9989 0.9975 0.9984 0.9980 !
10	1 3 3 2 3 1	30,877,000?	! 0.9989 ! 0.9984 0.9980 !
11	1 3 2 2 4 1	32,777,000?	! 0.9989 ! 0.9984 !
12	1 3 2 3 3 1	30,627,000	! 0.9989 ! 0.9995 !
13	1 4 2 3 3 1	31,886,000?	! ! ! 0.9995 !
14	1 3 2 4 3 1	30,677,000	! ! ! ! ! ALGORITHM STOPS HERE
			The symbols ! and ⁉ are used for: ! (This chosen component is removed from further consideration as cost constraint is violated). ⁉ (The cost constraint is violated).

Conclusion

In conclusion, this paper has addressed the critical challenge of optimizing system reliability within the constraints of limited budget allocations, focusing specifically on the paper manufacturing industry. By employing a heuristic algorithm (HA) to solve the redundancy allocation problem (RAP), we have demonstrated a practical and effective approach to enhancing system reliability.

Through a comprehensive review of existing literature spanning from 2000 to 2023, we have synthesized various methodologies used in reliability optimization, providing valuable insights into the evolving landscape of research in this domain. Building upon this knowledge, authors have proposed and implemented the HA-based optimization approach, showcasing its efficacy in achieving optimal reliability outcomes. The results obtained from this study highlight the significant improvements in system reliability achieved through strategic redundancy allocation, while ensuring cost-effectiveness and operational efficiency.

Limitations

There can be one limitation of this study such as redundancy allocation problem can be solved with more than one constraint such as volume and weight of the machines.

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Hydrogen Fuel: A Coming Era of Clean and Sustainable Energy

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Abstract

Green house gases have threatened the world on an alarming rate. Reducing these gaseous emissions is the need of the hour. To combat with the situation, alternate sources of energy are the need of the hour. Combustion of conventional fuel leads to exponential release of harmful and green house gases which imposes serious threats to the environment. In this study alternative source of energy, production hydrogen fuel is discussed by various methods. The working of various types hydrogen cell is discussed comprising different electrolytes. Transportation and storage being one of key factors of the cost of hydrogen production. Applications of H_2 fuel in various fields such as PED, efficient power backup are also discussed in detail.

Introduction

Environmental concerns are growing, with CO_2 emissions being a major concern. Hydrogen fuel, particularly polymeric electrolyte fuel cells (PEFCs) is a promising solution to reduce greenhouse gas emissions. These fuel cells offer high efficiency, excellent performance, and low temperatures, making them suitable for vehicle applications. They also address the limitations of electric vehicles, such as limited distance range and prolonged battery recharging times. The vehicle's autonomy depends on the amount of hydrogen stored on board. Advancements in hydrogen storage technology and shorter recharging times further enhance the feasibility of fuel cell technology for vehicles. Hydrogen fuel cells offer higher energy density and continuous operation, making them a potential future transportation fuel, bridging the gap between conventional and electric vehicles.

Literature Review

Gasification and pyrolysis of biomass crop and forest residues, as well as the solid wastes of plants, animals, and industry, are the sources of biomass (Demirbas *et. al*., 2001), (Kim *et. al.*, 2020). These main sources are thought to be carbon-neutral renewable energy sources. The amount of CO_2 emitted during

the thermochemical conversion of biomass is equivalent to the amount of CO_2 taken up by living things like plants and animals (Flamos *et. al.*, 2011).
Thermochemical method for converting biomass into hydrogen is pyrolysis. It is carried out without oxygen at temperatures between 350 and 550 °C and pressures between 0.1 and 0.5 MPa. (Demirbas *et. al*., 2001). Depending on the temperature and residence duration, the biomass can change into different amounts of liquids (bio-oil), gases (including H_2), and solid products. Another way to produce green hydrogen is through a second steam reforming reaction: bio-oil. Using a Ni active phase catalyst, steam reforming bio-oil yields 75% H_2 at 750˚C (Kim *et. al.*, 2020) . With catalysts made of platinum group metals, this rises to roughly 71–78% (Wang *et. al.,* 1998), (Czernik *et. al.*,2007). Synthetic fuels derived from biomass have enormous potential for use in upcoming hydrogen production methods.

The most popular method for producing H_2 from water splitting is electrolysis (Rossmeisl *et. al.,* 2005). Green hydrogen is created during a completely carbon-free process when electricity is produced using renewable energy sources (RES), such as solar, wind, or hydropower. The apparatus used in the electrolysis process is called an electrolyzer, and it consists of an anode and a cathode that are both submerged in the electrolyte. There are several commercial water electrolysis devices available, including SOEC (solid oxide electrolysis cells), alkaline, and PEM (Polymer Electrolyte Membrane) electrolyzers. **Table 1** provides the specs for these technologies. Alkaline electrolyzers produce the most hydrogen out of all of them, according to cell (Bhandari *et. al.,* 2014).

Table 1: Standard parameters for technologies involving electrolysis

Specification	**PEM**	**Alkaline**	**SOEC**
Maturity	Demonstration	State of the art	Research & Development
Stack lifetime, h	≤20,000	≤90,000	≤40,000
Cell pressure, bar	≤30	≤30	≤30
Hydrogen production, Nm^3/h	≤30	≤760	–
Cell voltage, V	1.8–2.2	1.8–2.4	0.95–1.3
Cell temperature, ˚C	50–80	60–80	900–1000
Voltage efficiency, %	67–82	62–82	81–86
Current density, A/cm^2	0.6–2.0	0.2–0.4	0.3–1.0
Hydrogen purity, %	≥99.999	≥98.8	–
Energy consumption, kWh/Nm^3	4.5–7.5	4.5–7.0	2.5–3.5

Adapted from (Malik *et. al.,* 2023).

Objective

- The objective of this study is to review the various synthetic techniques of H_2 production. Compare the different methods and analyze the most convenient, eco-friendly and less time consuming techniques.
- To analyze scalable and cheaper transport and storage techniques
- Understand the working of H_2 fuel cell, which may lead to scalable sustainable energy practices and a reliable alternate source of energy
- Acquire knowledge on various applications of H_2 fuel cell for societal needs

Research Methodology

The research methodology of the current study is done through literature survey and discussion on various types of techniques of synthesis, their working and proposed applications.

Results and Discussion

Working of H_2-O_2 Fuel cell

A fuel cell is a device that converts chemical energy from fuel into electrical energy continuously, offering advantages over combustion-based technologies in various fields like electronics, housing power, and transportation. Various types of fuel cells exist, categorized by electrolyte type, including AFCs, PEMFCs, PAFCs, MCFCs, and SOFCs, each with specific characteristics and operating temperatures. PEMFCs, known for their rapid start-up time and wide operating temperature range, are widely used in vehicles and stationary applications

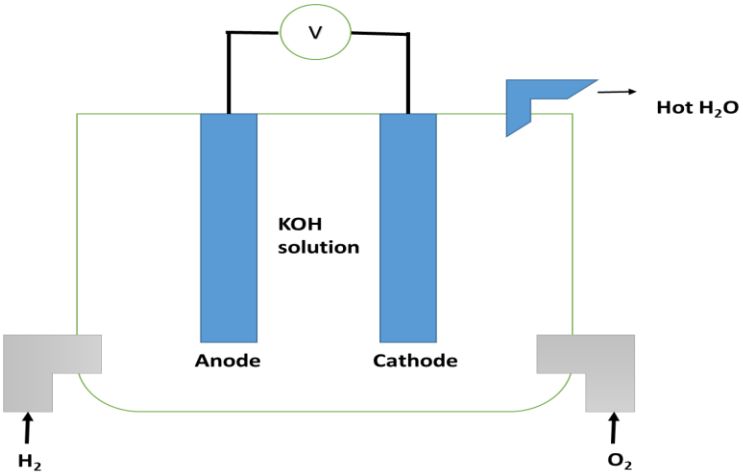


Figure: Schematic of the H_2- O_2 fuel cell

Storage and Transportation of Hydrogen Fuel

Storing and moving hydrogen is critical aspects that can greatly enhance the overall impact of hydrogen production. Overcoming the challenges of storing, transporting, and distributing hydrogen is crucial for its effective use as an energy carrier.

There are two types of hydrogen storage such as physical storage and chemical storage. The physical storage comprises of liquid H_2 tank, compressed H_2 tank and cryo-compressed H_2 tank, which all can be regenerated off-board. The chemical storage includes adsorbents such as metal organic framework (MOFs), carbon based. Chemical hydrides such as borohydrides, ammonia borane also acts as chemical binding sites for H_2 gas. Metal hydrides and complex metal hydrides can also reversibly bind the H_2 gas, thereby facilitating the storage.

Physical storage of Hydrogen Fuel: Storing and transporting hydrogen involves using high-pressure or super-cold tanks (Acres *et. al.*,2001).

Chemical based storage of Hydrogen Fuel: Material-based hydrogen storage encompasses chemical and physical sorption methods (Acres *et. al.*,2001).

Transportation of hydrogen fuel: There are various approaches to transport hydrogen, which can be categorized into two main types:

Continuous and batch transportation (Barbir *et. al.*,2005).

Applications of H_2 fuel

In the past decades, there has been significant attention given to the development of alternative energy sources such as wind, solar, hydro, and geothermal. However, these forms of energy cannot produce gaseous or liquid transportation fuels (Larminie *et. al.*, 2000).

Hydrogen (H_2) is perceived as an energy carrier and vector As well as the fuel of the future (Larminie *et. al.*,2000).The ability to release water during burning/ combustion defines the name ‘hydrogen’ i.e. ‘hydro’ mean-ing ‘water’ and ‘gen’ meaning ‘generate’.

Use of hydrogen in Portable electronic device (PED)

The use of hydrogen fuel cells in PEDs is steadily increasing due to advancements in cost and power supply dependability.

Hydrogen fuel cell smart house components and functions

The HFCSH will exemplify the integration of fuel cell technologies, specifically Solid Oxide Fuel Cells (SOFC) and Proton Exchange Membrane Fuel Cells (PEM). Key notable and innovative features of the HFCSH include:

- It has the capacity to produce and provide its electricity.
- Introduction of an energy-efficient fuel cell installation designed for residential housing, scalable to meet specific size requirements.
- The utilization of photovoltaic roof tiles to generate power
- It facilitates wastewater articulation and purification.

Hydrogen fuel cells for backup power applications

- Hydrogen fuel cells offer a dependable solution for backup power in critical infrastructure, boasting substantial uptime and minimal maintenance demands. In contrast to diesel generators, fuel cells lack moving components like pistons and crankshafts, which are susceptible to wear and necessitate frequent upkeep.
- Hydrogen fuel cells offer the potential for achieving energy self-sufficiency in critical infrastructure settings by generating power locally, thus reducing dependence on external sources.
- Hydrogen fuel cells boast a superior lifespan compared to traditional backup power options like diesel generators and lead-acid batteries. These fuel cells can function for upwards of 10,000 hours with minimal maintenance needs.

Conclusion

It can be concluded that hydrogen can be produced efficiently via photocatalysis utilising various light sources, pyrolysis of biomass and electrochemical splitting of water. Green hydrogen is also reported to be produced using renewable sources of energy such as solar energy, wind energy, etc. However solar stimulated hydrogen production only comprises of 16% due to the limited efficiency of PV panels. Solar-thermal panels exhibited better efficiency as compared to PV panels for larger scale production. Further utilising of these H_2 gas in H_2-O_2 fuel cell for generation of electrical energy are also discussed. Storing the generated hydrogen gas is challenging as they required high pressure and lower temperatures. Various methods can be involved to store and transport H_2 gas such as physical method involving cryo-tanks or chemical method using metal hydrides or organic hydrogen carriers to chemical bond to hydrogen for controlled release. Finally, the generated H_2 can be used in PEDs, power applications in smart houses for a sustainable and green future.

Limitations

The H_2-O_2 fuel cell can be a reliable alternative to non-sustainable fossil fuels, but the storage and transport is still challenging. Storing H_2 gas at ambient temperatures is still needs to be developed. The usage of H_2 gas commercially and in daily household still needs to be worked upon and research should be done to make it abundant and easily available at reasonable cost.

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Role of Intermittent Fasting in Diseased and Non-Diseased Condition

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Abstract

Intermittent fasting (IF) has gained significant attention for its potential health benefits and weight management effects. This paper provides an overview of IF, including its various methods, physiological mechanisms, and health impacts. Research suggests that IF can improve insulin sensitivity, promote weight loss, and enhance cellular repair processes. Different IF methods, such as the 16/8 method, alternate-day fasting, and the 5:2 diet, are discussed, each with unique approaches and benefits.

The paper delves into the physiological mechanisms of IF, including hormonal changes, autophagy, and metabolic adaptations, which help explain the associated health benefits. While promising, IF is not without limitations and considerations. Potential side effects like increased hunger, irritability, and difficulty maintaining the fasting schedule are examined. Additionally, the suitability of IF for various populations, such as pregnant women, individuals with certain medical conditions, and athletes, is explored.

In conclusion, IF is a promising dietary strategy that may offer several health benefits, including weight loss, improved metabolic health, and enhanced cellular repair. However, further research is needed to fully understand its long-term effects, optimal implementation strategies, and potential risks. IF holds potential as a valuable tool for promoting health and well-being when used appropriately and under medical guidance.

Introduction

Intermittent fasting (IF) has emerged as a fascinating dietary phenomenon that has captured the interest of researchers, health professionals, and the general public alike. This dietary strategy involves cycling between periods of eating and fasting, with varying durations and frequencies. Over the years, intermittent fasting has gained attention not only for its potential to facilitate weight loss but also for its diverse array of health benefits, including improvements in metabolic health, cellular repair processes, and longevity.

In recent decades, the prevalence of obesity, metabolic syndrome, and related chronic diseases has reached alarming levels globally, prompting a search for

effective dietary interventions to address these health challenges. Traditional approaches to weight management often focus on reducing overall calorie intake or promoting specific dietary patterns. However, the emergence of intermittent fasting represents a departure from conventional dietary paradigms, offering a novel perspective on how timing and frequency of eating may impact metabolic health and overall well-being [Heilbronn et al., 2005].
This review aims to provide a comprehensive overview of the current state of research on intermittent fasting, with a focus on its physiological mechanisms, potential health benefits, and implications for clinical practice.

Literature Review

Understanding the Mechanisms of Intermittent Fasting

The idea behind intermittent fasting is that by restricting food, our bodies will more quickly and efficiently tap our fat stores for energy. While glucose from carbohydrates is our most direct fuel source, we burn fat for energy when glucose isn't available [Longo et al., 2014]. This happens even more during times of food deprivation. Our ability to store fat is unlimited.
Intermittent fasting (IF) is an eating pattern in which individuals go extended periods with little or no energy intake after consuming regular food in intervening periods. IF has several health-promoting effects. It can effectively reduce weight, fasting insulin levels, and blood glucose levels.

- **Insulin Sensitivity**: Intermittent fasting can improve insulin sensitivity, meaning cells become more responsive to insulin, a hormone that regulates blood sugar levels. Improved insulin sensitivity can lead to better blood sugar control and reduced risk of type 2 diabetes.

- **Cellular Repair and Autophagy**: During fasting periods, cells initiate a process called autophagy, where they break down and remove dysfunctional components. This process helps clear out damaged proteins and organelles, promoting cellular repair and renewal.

- **Gene Expression**: Intermittent fasting can alter the expression of genes related to longevity and health. Certain genes involved in cellular repair, stress resistance, and metabolism may be upregulated during fasting, contributing to improved overall health and longevity.

- **Hormonal Changes**: Fasting triggers changes in hormone levels, including increased release of norepinephrine and growth hormone. These hormones can boost metabolism, enhance fat burning, and preserve muscle mass.

- **Caloric Restriction**: Intermittent fasting often leads to a reduction in overall calorie intake, which can contribute to weight loss and improved metabolic health. By limiting the window of time during which food is consumed, individuals may naturally consume fewer calories without actively restricting their diet.

- **Inflammation Reduction**: Some research suggests that intermittent fasting may help reduce inflammation in the body. Chronic inflammation is linked to various health problems, including heart disease, cancer, and autoimmune disorders. By reducing inflammation, intermittent fasting may lower the risk of these conditions.

- **Brain Health**: Intermittent fasting has been shown to have neuroprotective effects and may support brain health. It can stimulate the production of brain-derived neurotrophic factor (BDNF), a protein that promotes the growth and protection of neurons, as well as enhance the production of ketones, which serve as an alternative fuel source for the brain.

- **Gut Health**: Intermittent fasting may positively impact gut health by promoting a healthy gut microbiome. Fasting can alter the composition of gut bacteria in a way that may be beneficial for digestion, immune function, and overall well-being.

These mechanisms collectively contribute to the various health benefits associated with intermittent fasting, including weight loss, improved metabolic health, enhanced cognitive function, and increased longevity. However, it's important to note that individual responses to intermittent fasting can vary, and it may not be suitable for everyone. It's recommended to consult with a healthcare professional before starting any fasting regimen, especially for those with underlying health conditions or specific dietary needs [Hoddy et al., 2017]. We now know that fasting results in ketogenesis; promotes potent changes in metabolic pathways and cellular processes such as stress resistance, lipolysis, and autophagy; and can have medical applications that, in some cases, are as effective as those of approved drugs such as the dampening of seizures and seizure-associated brain damage and the amelioration of rheumatoid arthritis [Bruce-Keller et al., 1999, Hartman et al., 2012, Müller et al., 2001]. In most mammals, the liver serves as the main reservoir of glucose, which is stored in the form of glycogen. In humans, depending upon their level of physical activity, 12 to 24 hr of fasting typically results in a 20% or greater decrease in serum glucose and depletion of the hepatic glycogen, accompanied by a switch to a metabolic mode in which non hepatic glucose, fat-derived ketone bodies, and free fatty acids are used as energy sources. [Schübel et al., 2018]

Physiological Changes During Intermittent Fasting -There are many things that happen during intermittent fasting that either don't happen or that happen very slowly when we are always eating. In a well-fed state, the individual cell in your body is in "growth" mode. Its insulin signalling and mTOR pathways that tell the cell to grow, divide and synthesize proteins are active. By the way, these pathways, when overactive, have implications in cancer growth. The "mammalian target of rapamycin" or mTOR loves having plentiful nutrients around, especially carbohydrates and proteins. When active, mTOR tells the cell not to bother with autophagy (literally cellular "self-eating"), a recycling and cleanup process that rids your body of damaged and misfolded proteins, for example. The well-fed cell isn't worried about being efficient and recycling its components – it's too busy growing and dividing [Matthew et al., 2022].

In a well-fed state, your cells and their components are also highly acetylated. This means that various molecules in your cells, including the "packaging" proteins called histones that wrap your DNA up nicely within the core of your cells, are "decorated" with acetyl groups on their lysine (amino acid) residues. Don't worry if you don't understand the jargon in that last sentence. What you really need to know is that the well-fed cell has many genes, including those associated with cellular survival and proliferation, turned on. This is because acetylation tends to loosen the packaging proteins that normally keep your DNA wrapped up, and lets your DNA be read for protein production. While your cells turn on cellular growth and proliferation genes when you aren't fasting, they also turn other genes off. These include genes related to fat metabolism, stress resistance and damage repair. Actually, with intermittent fasting some of your fat gets turned into ketone bodies that appear to reactivate these genes, leading to lowered inflammation and stress resistance in the brain.

Research Gap

To the question of intermittent fasting's long-term effects in humans point to two other areas requiring further research. Studies are needed to determine whether this eating pattern is safe for people at a healthy weight, or who are younger or older, since most clinical research so far has been conducted on overweight and middle-aged adults. Published research is needed summarize to identify safe, effective medications that mimic the effects of intermittent fasting without the need to substantially change eating habits.

Objectives

To conduct the retrospective literature search and find the potential studies.

To collect the relevant data, summarize the significant information.

Hypothesis

It's important to emphasize that individual responses to intermittent fasting can vary, and its effectiveness may depend on factors such as the specific fasting protocol, overall diet quality, and individual metabolic characteristics. Before starting any new dietary regimen, including intermittent fasting, it is advisable to consult with a healthcare professional or a registered dietitian, especially for individuals with pre-existing health conditions.

Research Methodology

We performed a systematic literature search using PubMed, ScienceDirect, Medline and SpringerLink and google scholar databases to retrieve relevant published research articles by using various combination of keywords including “intermittent fasting”, “diabetes”, “cardiovascular disease” “16/8 strategy” “5:2 Diet”, “weight loss”, “insulin sensitivity”, “blood pressure”, “stress”, “aging”, “cognitive” to filter out the required published paper and we made sure all the papers were published in English. The retrieved studies were studies and evaluated systematically and signification information of intermittent fasting and its effect on disease and other parameter like weight, stress, etc.

Results

Effect with clinical issues

- **Obesity:** Intermittent fasting prevented obesity. It says obese adult humans lost weight through intermittent fasting. The most successful participants lost approximately 0.5 to 1 kg per week of the study.
- **Diabetes mellitus :** A research conducted that a 3-month intermittent fasting diet intervention among 36 people with diabetes and found almost 90% of participants, includes those who took blood sugar lowering agent and insulin, reduce their diabetes medication intake after intermittent fasting.

- **Cancer:** A recent study and few preliminary human trials shown that intermittent fasting decreases the risk of cancer or a decrease the risk of cancer. A combination of healthy diet and regular exercise helps you from prevention of cancer.
- **Neurodegenerative disorder:** By counteracting the accumulation of damage as it happens in most of neurodegenerative disease, the up regulation of the autophagy process in response to fasting can potentially exert a protective role in neurodegenerative disease.
- **Arthritis:** The research suggests that intermittent fasting may more beneficial than other diet for reduce inflammation and condition associated with inflammation. Therefore, it is very helpful in case of arthritis.
- **High blood pressure:** The large-scale clinical trials confirmed that intermittent fasting can reduce body weight and body fat, improve insulin levels, lower blood pressure. The blood pressure returning to its usual level after fasting.
- **Cardiovascular disease:** Intermittent fasting can improve heart rate variability while resting heart rate and blood pressure. If you are healthy so it can prevent from coronary artery disease, heart attack, hypertension and any other cardiac disease.

Discussion

Intermittent fasting (IF) is a dietary strategy that involves alternating periods of abstention from calorie consumption with periods of *ad libitum* food intake [Sundfor et al., 2019]. Intermittent fasting has facilitated many approaches to health benefits. Among these approaches like alternate day fasting, time restricted feeding and other new regimens have gained significant attention within the years and have been researched on [Gabel et al., 2018; Headlan et al., 2016; Moro et al., 2016]. This includes research on insulin sensitivity, aging.

The most common benefits known for intermittent fasting is weight loss but aside that there is a promising number of other benefits. Research showed that after 24 weeks of unsupervised follow up, there were changes in body composition using alternate day fasting with more favourable changes in% fat mass and lean mass [Catenacci et al., 2016; Templeman et al., 2018]. Even though the research was carried out on animals, new data has emerged concerning humans especially for weight loss and improving diseases like diabetes and heart diseases [Mattson et al., 2014, Malinowski et al., 2019]. Based on knowledge, we know that how much we eat determines weight loss more than how often or when we eat [Cho et al, 2019].

According to a systematic review, IF was studied in 27 trials showing weight loss ranging from 0.8% to 13.0% of baseline weight, with no serious adverse events [Welton et al., 2020]. This is a very welcoming news for people trying to lose weight but due to the fact that the studies were short term, it's not very clear whether IF can really help maintaining a healthy weight in the future. A review article [de Cabo et al., 2019] showed a clear connection between intermittent fasting longevity.by IF you'll be able to maintain a healthy body weight which helps preventing chronic diseases. you'll also reduce your oxidative stress and inflammation, both of which are the top causes of aging. Even thigh IF helps with longevity it is best advice to couple it up with regular physical activities sleeping properly and ingesting foods that are healthy.

According to research were most of the respondents had a high BMI, a combination of overweight (35.4%), obese (23.1), and morbidly obese (1.4%). a total of 94, 5% lost weight and 4.1% had a significant decrease in weight [Shalabi et al., 2023].

A systematic review of 40 studies found intermittent fasting to be effective for weight loss, typically resulting in a loss of 7-11 pounds over 10 weeks. Studies varied greatly in size (from 4 to 334 subjects) and duration (from 2 to 104 weeks) [Seimon et al., 2015]. A year-long randomized controlled trial comparing alternate-day fasting to daily calorie restriction showed no significant differences in weight loss, body composition, or cardiovascular risk factors between the two groups [Trepanowski et al., 2017]. However, the alternate-day fasting group had higher LDL cholesterol levels and a higher dropout rate. Interestingly, participants in the fasting group consumed less food than prescribed on non-fasting days but exceeded the prescribed intake on fasting days.

Conclusion

Numerous researches claim that fasting intermittently may aid in losing weight. However, there is still more work to be done to find out how it works and whether it can really prevent diseases in the long term. You should also note that IF may not produce similar results for everyone. For some individuals, they might feel hungry or weak as they practice this method. Therefore, you need to consult a physician prior to having any changes in your dietary program such as trying IF.

Limitations

At last, despite existing promising data about positive impacts of doing intermittent fasting (IF), there are still lots of things left unclear which are worth studying further. It would be also necessary to talk about individuality in relation to difference between people considering if it's beneficial to anyone at all. The more we know about it, the better we will choose when deciding if this diet regimen is right for us and how we can use it safely.

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Microbial Electrochemical System: An Approach to Remediate Emerging Water Contaminants

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Abstract

Microbial electrochemical systems (MES) represent an innovative approach to wastewater treatment, offering the dual benefit of effective pollutant removal and valuable resource recovery. With the utilization of robust microbial biocatalysts, MES have shown promising results in removing emerging contaminants (EC) from wastewater. This review focused on recent advancements in the removal of complex organic pollutants i.e. pesticide, heavy metal, and PAHs etc., using MES technology, particularly addressing the challenges posed by EC that are not effectively treated by conventional wastewater treatment methods and often released into the environment untreated. Further, discussed on the application of MES in in remediation of EC, optimization and identification of microorganisms. Ultimately, the review aims to support researchers in developing more efficient MES for tackling EC in wastewater treatment.

Introduction

Rising pollution and global warming, coupled with growing demand of energy and fossil fuel present significant challenges. Securing clean water and energy is crucial. Energy recovery from waste and wastewater offers a solution, providing renewable bioenergy while addressing waste management. Wastewater can be a valuable resource for bioenergy generation and remediation through biological processes [Zakaria & Dhar, 2022]. Source of wastewater can be domestic waste, sewage sludge, textile wastewater, winery wastewater etc. [Wang et al., 2022]. Microbial electrochemical system (MES) represents a mixture of technologies. That utilizes special capability of microorganism to convert chemical energy into electrical energy vice versa. This characteristic offers a potential alternative to relying on fossil fuels for electricity generation and avoiding the production of harmful compounds in chemical manufacturing processes [Lu et al., 2023].

Literature Review

Microbial Electrochemical Systems (MES) offer a promising method for treating emerging water contaminants. Previous studies have shown their effectiveness in removing pollutants like pharmaceuticals and industrial chemicals. Research has focused on optimizing MES performance through electrode materials and reactor design. Challenges include scalability and long-term stability. Despite this, continued innovation in MES technology holds potential for sustainable water treatment solutions. This is simply not enough to power our homes or cities. Researchers are working on improving the design and materials used in MFC to increase their power output. Scaling Up: MFCs that work well in the lab often struggle when scaled up to larger sizes. This is because factors like distance between electrodes and internal resistance become more significant at larger scales [Wang et al., 2022]. Biosensing devices offer a glimpse into a world of real-time health monitoring and analysis, but they still face some challenges. Biosensors rely on biological recognition elements like enzymes or antibodies to detect target molecules. While these can be highly specific, there can be interference from similar molecules in the environment. Research by Tetyana et al. Discusses this challenge, highlighting the importance of selecting the right biological receptor for optimal specificity [Zakaria & Dhar, 2022].Sensitivity sometimes, the target molecules may be present in very low concentrations. The sensor may not be sensitive enough to pick up on these faint signals, leading to inaccurate readings. Biocompatibility and User Comfort Biosensing devices, especially wearable ones, need to be comfortable and biocompatible for long-term use. Skin irritation and allergic reactions can occur, limiting wearability. A research paper by Lim et al. explores these limitations of current wearable biosensing devices [Wang et al., 2022]. While Microbial Electrolysis Cells (MECs) hold promise for wastewater treatment, there are some limitations to consider Low Organic Removal Efficiency MECs are often less efficient at removing organic matter compared to conventional wastewater treatment methods like activated sludge processes [Zakaria & Dhar, 2022]. This means they may require additional treatment steps to meet discharge standards. MECs primarily focus on organic matter degradation and have limited capabilities for removing nitrogen and phosphorus, which are also major pollutants in wastewater [Wang et al., 2022]. Additional processes might be needed for complete nutrient removal. MECs can recover energy from wastewater in the form of electricity. However, the current generated is typically low, making large-scale energy production impractical at this stage [Lu et al., 2023]. Biofilm Formation and Maintenance: The efficiency of MECs relies heavily on the health and activity of the microbial biofilm on the electrode. Maintaining optimal conditions and preventing excessive biofilm growth can be challenging [Zakaria & Dhar, 2022]. MEC technology is still under development compared to established wastewater treatment methods.

Research Gap

Microbial electrochemical system is currently designed for lab use only; it needs scaling up for the field applications. To improve the long-term performance of MES, further studies are needed with both pure and mixed microbial communities. These studies aim to understand the optimal conditions for monitor microbial dynamics and develop new reactor designs and operational strategies for efficient hydrogen production using MEC technology.

Objectives

Identify the emerging contaminants in the aquatic environment and apply MES in wastewater treatment for biodegradation of emerging contaminants.

Hypothesis

The integration of robust biofilms rather than individual culture in MES would enhance the removal efficiency of emerging contaminants in MES compared to conventional treatment methods.

Research Methodology

Design a sampling strategy that considers the spatial and temporal variability of contaminants in the aquatic environment have been searched and highlighted using published literature. Selection of sample based on locations of potential sources of contamination, such as industrial discharge points, agricultural runoff, and urban areas has been done. Optimizing and developing Microbial Electrochemical Systems (MES) involves careful consideration of various factors to enhance performance; efficiency and its application have been reviewed through literature.

Findings

This article discussed the advancements made in the first and second generations of MES and also touched upon recent innovations in the field, such as utilizing nanostructured materials to enhance the performance of electrodes and combining MES with spectroscopy techniques. By employing nanostructured electrodes that offer high conductivity, a large surface area, and significant enhancements in interactions between microbes and electrodes, as well as in the extracellular electron transfer process, have be highlighted. Scientists are still working on a universally agreed-upon definition of what it means for a microorganism to be “electroactive.” There is no one-size fits-all

test to classify them, but depending on the experiment or real-world application, researchers might focus on different characteristics.

Here are general conditions for each aspect have been reviewed and mentioned:

- **Selection of Microorganisms**

  Microorganisms capable of electroactive behaviour, such as exo-electrogens, which can transfer electrons to or from electrodes are main factors for bioremediation process. Microbial diversity and community dynamics to maximize metabolic diversity and system resilience has been done [5].

- **System Design and substrate selection**

  MES configurations have been designed based on specific applications and performance requirements. Optimization of reactor geometry, electrode spacing, and flow dynamics to facilitate efficient electron transfer and substrate mass transport. Choose substrates (electron donors or acceptors) that support microbial growth and metabolism while promoting electron transfer to electrodes. Substrates can include organic compounds (e.g., acetate, glucose), inorganic compounds (e.g., sulfide, nitrate), or complex wastewater streams.

- **Control of Operating Conditions**

  Maintain favourable environmental conditions, such as pH, temperature, and dissolved oxygen levels, to support microbial activity and electrode performance. Implement process control strategies, such as feedback control loops or automated monitoring systems, to regulate key operating parameters [Luo et al., 2012].

- **Electrode Modification**

  Modify electrode surfaces to enhance microbial attachment, biofilm formation, and electron transfer kinetics. Techniques include surface functionalization, coating with conductive polymers, or deposition of catalytic nanoparticles [Li et al., 2023].

- **Electrolyte Composition**

  Optimize electrolyte composition to provide essential ions for microbial metabolism and facilitate ion transport within the system.

Consider factors such as conductivity, buffering capacity, and compatibility with microbial activity [Li et al., 2023; Luo et al., 2012].

- **Cathodic Reactions**

Design cathodes to promote efficient reduction reactions, such as oxygen reduction for oxygen-consuming MES or alternative cathodic reactions (e.g., hydrogen evolution) for hydrogen-producing MES.

Select cathode materials and operating conditions to minimize overpotentials and maximize energy conversion efficiency. By carefully considering these general conditions and optimizing each aspect of Microbial Electrochemical Systems, researchers and engineers can develop efficient and scalable platforms for various applications, including wastewater treatment, bioenergy production, and resource recovery.

- **Application of MFC in degradation**

There has been shortage of energy and water due various factors such as increasing demand of energy both at commercial and domestic, increasing population leads to the increase water usage, ecological changes and high cost [Roy & Pandit, 2019].

MFCs are a system which generates electricity with help of microorganism. When waste-water is treated with help of MFC it generates electricity while cleaning the water by degrading the pollutants. MFC is more efficient than traditional techniques as they require energy overall affecting the cost of system, whereas MFC can reuse the energy produce by the system [Luo et al., 2012; Ivase et al., 2020; Wang & Ren, 2013]. Polycyclic aromatic hydrocarbons (PAHS) are organic substance that are hardly biodegradable and also are carcinogenic. There have many reports that PAHs can be removed by bio-electrochemical system. There are many parameters that are focused for biodegradation which are configurational parameters such as anode and cathode design , also environmental parameters like salinity, adsorption and sediment that affect PAH degradation in BES (Kronenberg et al., 2017).

Conclusion

In this paper, the bioremediation of complex organic pollutants i.e. pesticide, heavy metal, and PAHs etc., using MES technology has been discussed for effective treatment of wastewater which is often released into the environment untreated. Application of MES in in remediation of EC,

optimization and identification of microorganisms were ultimately, reviewed to support the researchers in developing more efficient MES for mitigating EC present in wastewater.

Limitations

Microbial fuel cells (MFCs) are a promising technology, but they still have some limitations that hinder their widespread adoption. Here are some of the key challenges Low Power Density MFCs currently produce a low amount of power, measured in mill watts per square meter (mW/m^2). Setting up MEC systems can be expensive due to the need for specialized electrodes, membranes, and other equipment is still challenging.

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Machine Learning for Sustainable Development

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Abstract

Nowadays, more academic and industrial researchers are interested in sewage treatment in sustainable cities. As a result, it is essential to monitor and maintain these plants because industrial wastewater is typically extremely toxic and contributes to city pollution and health issues. A smart sewage treatment system for a fine chemical plant that uses sensors from the Internet of Things and machine learning is presented in our paper. Temperatures during various treatment processes, device operation parameters, and real-time Chemical Oxygen Demand (COD) over the past twenty months are among the data gathered by this implemented system. The experimental results show that the GRU model performs better than LSTM and SVR (MAPE = 10.18 percent, RMSE = 35.67, MAE = 31.16). The treatment of various waste water cases in sustainable cities could be the subject of additional research.

Introduction

As the economy expands, so do the number of industries and sewage emissions. Industrial sewage that is released freely without treatment not only harms the environment but also has unintended repercussions. Many nations are now experiencing industrial water contamination issues, and industrial sewage is common [Amin et al., 2019]. Furthermore, as the economy expands so will the number of industries and sewage emissions.

The industrial wastewater generated is released immediately without treatment, not only polluting the environment but also causing unexpected complications. Industrial water pollution is currently a widespread concern in many nations, and industrial sewage is commonplace.

Currently, numerous nations grapple with industrial water pollution issues, with industrial wastewater often containing highly toxic substances that pose significant risks to urban environments and public health. This pollution not only threatens residents' well-being but also hampers industrial productivity, leading to increased morbidity rates and potentially endangering lives. In essence, sewage pollution has adverse effects on both residents' health and industrial operations [Bibri & Krogstie, 2017]. Furthermore, sustainability has

emerged as a focal point in research concerning smart cities and contemporary societies, highlighting the importance of water resource management in fostering sustainable urban environments.

Effective treatment of industrial wastewater is essential to ensuring the sustainable development of smart cities, safeguarding residents' health, and reducing further environmental degradation. Many governments and other relevant organizations have allocated significant investments to the construction of sewage treatment facilities as a result of the significant attention that the treatment of sewage in sustainable urban areas has received from both academic and industrial circles. However, it is important to note that while large-scale sewage treatment plants have received a lot of attention, small-scale facilities have not received nearly as much attention. In order to prevent further environmental degradation, among other things, it is essential to properly treat industrial sewages. This would encourage more academics and businesspeople to talk about sewerage treatment in such communities that would be able to listen by using the innovations that have been made through research or inventions thus far [Carvalho et al., 2019].

A smart sewage treatment system based on machine learning and Internet of Things sensor networks is applied to a fine chemical plant in this paper. In order to guarantee the safety and stability of water plants and cut costs, this research altered the operating modes of conventional water systems.

Literature Review

The literature on machine learning applications for sewage systems not only shapes and plays in continuous advancement. Lately, many papers have concentrated on a range of methods to make these systems more efficient and robust using machine learning. Here are some key themes and findings from recent research:

- **Predictive Modeling:** Seekers devised some models of forecasting that have proved to be very helpful in anticipating the different other operations of sewage system, including blockages, overflows and equipment failures. The models, most of which are built on supervised learning algorithms like regression or classification, will ensure future events are accurately predicted just like the historical data is used [Chen et al., 2019].

- **Anomaly Detection:** Algorithms of anomaly detection have been developed to recognize abnormal patterns or events in sewage system data e.g. an instant flow rates change or an unusual measurement of a

sensor which is indicative of leaks or blockages. There are unsupervised learning algorithms among which clustering or density-based algorithms are the most productive in the detection of anomalies [Edmondson et al., 2018].

- **Real-time Monitoring:** The technology of sensor and data processing algorithms has thus made it easy to incorporate real-time monitoring systems for sewage networks in the current era. Machine learning algorithms allows a round-the-clock monitoring of sensor data streams, which helps to give early signal of any concerns and to react on time to take preventing steps from system failure or environmental damage [Manogaran et al., 2020].

- **Optimization of Maintenance Practices:** Particular optimization algorithms are being searched-to-be-developed with regard to evolution of maintenance schedules, resources allocation, and system parameters (operational). The study has pursued linking smart maintenance with machine learning and optimization methods in order to boost the effectiveness of maintenance procedures and to decrease related operating costs while keeping minimum disruptions to system functioning [Guo et al., 2018].

- **Integration of Data Sources:** The research about data integration and tools such as sensor data, GIS, weather data, and hydraulic models, has been investigated to accommodate insights into sewage systems performance. With the help of machine learning technology such as data fusion and feature selection, new useful information can be extracted from data sources that were previously considered heterogeneous [Singh et al., 2023].

- **Decision Support Systems:** For decision-making support purposes, decision support systems (DSS) including machine learning models have been created to assist wastewater systems operators and managers in decision making process which is based on the current conditions. These systems deliver observable outcomes, such as to point an alert, analyze scenario and optimization recommendations to improve system efficiency and ensure its survivability.

This paper introduces an intelligent sewage treatment system that utilizes machine learning and Internet of Things sensors to aid in managing sewage treatment within a fine chemical plant. The system collects various data such as temperatures across treatment processes, device operation parameters, and real-time Chemical Oxygen Demand (COD) over twenty months. Due to the chaotic

nature of wastewater treatment plant dynamics, traditional modeling approaches struggle to provide accurate results, necessitating more advanced techniques [Baum et al., 2023].

This study suggests employing extreme learning machine (ELM), support vector machine (SVM), and comparing them with conventional autoregressivee integrated moving average (ARIMA) for modeling the Bunus regional sewage treatment plant. Additionally, the study focuses on Biological Oxygen Demand (BOD), a crucial parameter for wastewater treatment plant efficiency, and explores the effectiveness of ELM algorithms in predicting effluent BOD. The research concludes that non-linear black-box models like ELM and SVM offer potential improvements over linear models such as ARIMA in modeling effluent BOD [Chui et al., 2018].

Research Gap

For the machine learning in sewage systems, a research gap exists in an accurate prediction of when sewer will fail or block and optimizing of maintenance schedules through coming up with an efficient predictive model. Additionally, there should be improvements made on how real-time monitoring is done to detect any abnormal occurrence and also combining data from different sources for better understanding of behavior within the system. Furthermore, not many studies have concentrated on using machine learning to optimize resource allocation as well as decision-making process within wastewater management systems.

Objectives

The objectives of this research are:

- To detect anomalies by identifying unusual patterns in sewage flow or quality data, which may indicate leaks, blockages, or contamination.
- To predict maintenance requirements through analysis of historical data, sensor readings, and predictive models, thereby reducing downtime and preventing failures.
- To optimize the efficiency of sewage treatment plants, reducing energy consumption and minimizing environmental impact.
- To assess risk by evaluating the potential for overflow or pollution events using real-time data, weather forecasts, and other factors, enabling proactive measures.

These objectives aim to enhance operational efficiency, minimize environmental impact, ensure public health and safety, and optimize resource utilization in sewage systems [Donthu et al., 2021; Farrukh et al., 2020].

Hypothesis

When sewage systems use machine learning to monitor water quality parameters in real time, it will be easier and quicker to spot deviations from environmental standards than with traditional monitoring methods. Using machine learning models for predictive maintenance in sewage treatment plants will cut down on downtime and save money on maintenance, making critical infrastructure last longer.

Anomaly detection systems that are based on machine learning will perform better when it comes to identifying pollution events or abnormal patterns in sewage systems. This will improve environmental protection and speed up response times.

The implementation, operation, and upkeep costs of machine learning solutions developed for sewage management will demonstrate their viability in a wide range of settings, including resource-constrained environments [Gupta et al., 2021]. Waterborne diseases and other risks to public health that are associated with inadequate wastewater treatment will decrease as a result of improved sewage management made possible by the application of machine learning. Water quality parameters can be monitored in real time using machine teaching [Kumar et al., 2021].

Results

- **Workload Reduction**: The investigation described in the paragraph has shown a significant reduction in the workload and difficulty of work for sewerage professionals. This suggests that advancements in technology or methodologies have made sewage treatment processes more efficient and manageable.

- **Application in Sustainable Cities**: The findings of the investigation can be extrapolated to various sewage treatment scenarios in sustainable cities, including small-scale industries with hazardous waste. This implies that the methods or technologies developed could have broader applicability beyond the initial scope of the study [Liengpunsakul, 2021].

- **Research Overview**: The paragraph briefly mentions a look back at the current state of research on sewage treatment and related technologies. This suggests that the investigation is building upon existing knowledge and possibly addressing gaps or limitations in previous research.

- **Intelligent Sewage Treatment Systems**: An overview of the design philosophy and theoretical underpinnings of intelligent sewage treatment systems is provided. This indicates that the investigation involves the development or analysis of advanced systems that utilize intelligence, possibly through automation or data-driven approaches [Muthukrishnan et al., 2020].

- **Machine Learning in Waste Management**: The paragraph suggests the use of machine learning methods to analyze data from social media and public comments to understand community opinions on waste management practices. This highlights the potential of machine learning in gathering insights from large volumes of unstructured data for decision-making purposes.

- **Community Engagement and Policy Alignment**: By identifying areas of concern or dissatisfaction among citizens, authorities can align their communication strategies and policies to address community preferences and needs. This emphasizes the importance of incorporating public feedback into waste management strategies for better community engagement and acceptance [Singh et al., 2022].

- **Improving Sustainability**: Overall, machine learning is seen as offering ways to improve sustainability in waste management through better resource utilization, anomaly detection, and data-driven decision support tools. This suggests that the integration of machine learning techniques can lead to more efficient and effective waste management practices, ultimately contributing to environmental sustainability [Sætra, 2021].

Conclusion

The majority of wastewater originates from hazardous and intricate industries, signifying the critical need for effective management strategies to address environmental concerns and safeguard public health. Monitoring and anticipating maintenance requirements in sewage treatment facilities are paramount for ensuring the sustainability of cities and the well-being of inhabitants. To tackle these challenges, a novel approach is proposed in this study: the utilization of IoT sensors and machine learning for monitoring air quality in smart cities. Specifically, the study focuses on implementing an

intelligent sewage treatment system based on machine learning and IoT sensors within a fine chemical plant setting [Singh et al., 2021].

The integration of advanced technologies offers promising solutions to optimize sewage treatment processes, improve efficiency, and mitigate environmental risks. The experimental findings demonstrate the effectiveness of the proposed intelligent sewage treatment system in the targeted industrial locations. Moreover, the study highlights the transformative impact of altering the operation modes of conventional water systems, emphasizing stability, safety, and cost reduction in water treatment plants.

By leveraging machine learning and IoT capabilities, the proposed system not only enhances the management of wastewater but also presents opportunities for sustainable resource utilization and economic benefits. This paradigm shift towards intelligent sewage treatment systems underscores the potential for technological innovation to drive positive outcomes in environmental sustainability and public health protection. As cities continue to grapple with the challenges of wastewater management, the adoption of such advanced solutions holds promise for creating healthier, more resilient urban environments.

Limitations

- **Data availability and quality:** In order to train machine learning models, they need a lot of high-quality data. However, the performance of ML algorithms may be affected by the limited, noisy, or incomplete data from sewage systems.

- **Interpretability:** Some models of machine learning, such as deep neural networks, are frequently regarded as black boxes, making it challenging to comprehend how they make decisions. Trust and comprehension can be harmed by this inability to be interpreted, particularly in critical applications like sewage management.

- **Generalization:** Due to differences in infrastructure, geography, and operating conditions, ML models trained on data from one sewage system may not work well with other systems. Scalability and transferability of models between locations are hampered as a result.

- **Sewage systems' complexity:** Sewage systems are dynamic and complex, and various components interact with one another. It can be difficult to capture these complexities in machine learning models, resulting in potential errors or over simplifications [Singh et al., 2021].

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Development of Materials for Organic Semiconductors

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Abstract

Semiconductor materials are integral to modern electronics, enabling the functionality of various devices that affect our daily lives. This research paper investigates the potential of organic semiconductor materials, specifically anthracene and naphthalene, in diode fabrication. While traditional inorganic semiconductors have long dominated the field, organic alternatives present opportunities for enhanced performance, cost-effectiveness, and versatility in device design.

Anthracene and naphthalene, both polycyclic aromatic hydrocarbons, possess unique molecular structures and electronic properties conducive to semiconductor applications. Their π- conjugated systems facilitate efficient charge transport, leading to desirable characteristics such as high carrier mobility and low energy band gaps. Moreover, their organic nature allows for straightforward synthesis, processing, and compatibility with flexible substrates, promising advancements in flexible and wearable electronics.

In this research, the performance of anthracene-based and naphthalene-based organic diodes with traditional inorganic counterparts have been compared. By evaluating factors such as rectification ratios, power consumption, and device reliability, the potential advantages and limitations of organic semiconductor diodes would be elucidated. Insights gained from this study could inform future developments in organic electronics and contribute to the evolution of semiconductor technology.

Introduction

Semiconductor materials form the backbone of modern electronics, underpinning a vast array of devices that have become integral to our daily lives. From smartphones to solar panels, semiconductors enable the functionality of countless technologies. In this report, the authors have delved into the fundamental principles and applications of semiconductor materials, exploring their significance in electronic systems and beyond.

At the heart of semiconductor materials lie their unique electrical conductivity properties. Unlike conductors, which readily allow the flow of electrical current, and insulators, which block it entirely, semiconductors exhibit a conductivity that falls between these extremes. This characteristic is attributed to the energy band structure of semiconductors, where electrons can occupy discrete energy levels within the material.

One of the defining features of semiconductors is their band gap, the energy difference between the valence and conduction bands. This band gap dictates the semiconductor's ability to conduct electricity and serves as a crucial parameter in device design and optimization. By selectively modifying the band gap through doping and other techniques, engineers can tailor semiconductor materials to suit specific applications.

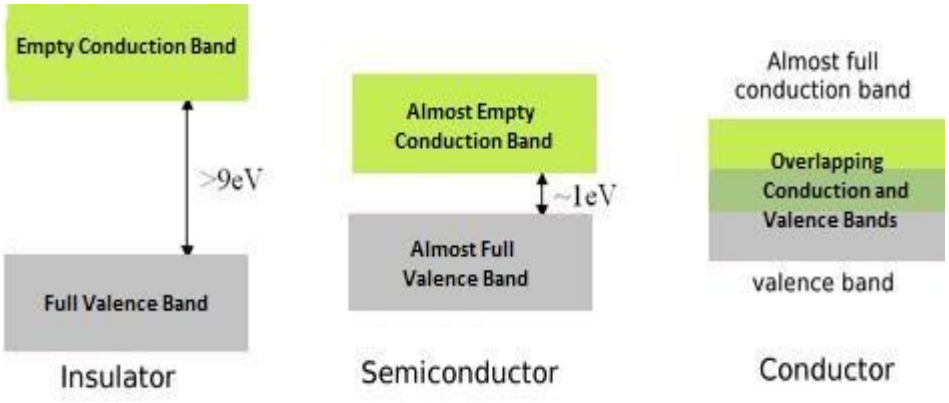


Figure: Band gap structure of Insulator, Semiconductor and Conductor

Semiconductors find widespread use in electronic devices, serving as the building blocks for transistors, diodes, and integrated circuits. Transistors, for instance, act as amplifiers or switches, enabling the manipulation of electrical signals in electronic circuits. Diodes, on the other hand, facilitate the control of current flow, essential for tasks such as rectification and signal modulation.

Beyond electronics, semiconductor materials also play a vital role in emerging fields such as optoelectronics, photonics, and renewable energy. Light-emitting diodes (LEDs) leverage semiconductor properties to emit light efficiently, contributing to energy efficient lighting solutions. Similarly, photovoltaic cells harness the photovoltaic effect in semiconductors to convert sunlight into electrical energy in solar panels.

In this report, the aim is to provide a comprehensive overview of semiconductor materials, covering topics such as crystal structure, band theory, doping, and device applications. Through this study, the authors seek to deepen

understanding of these foundational materials and their role in driving technological innovation across various domains.

Anthracene in Diode Fabrication

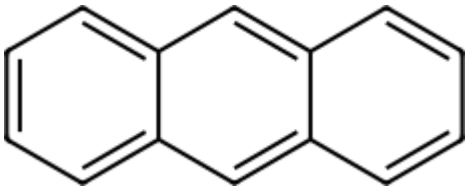


Figure: Structure of Anthracene

Anthracene, a polycyclic aromatic hydrocarbon composed of three fused benzene rings, holds significant promise as a semiconductor material in the construction of diodes. Its unique molecular structure and electronic properties make it a compelling candidate for electronic applications, particularly in the realm of organic electronics.

Anthracene exhibits semiconducting behaviour due to its π-conjugated system, which facilitates delocalization of electrons across its molecular structure. This delocalization gives rise to extended π-electron clouds, enabling efficient charge transport within the material. As a result, anthracene-based semiconductors demonstrate desirable electronic characteristics, including high carrier mobility and low energy bandgap.

In the context of diode fabrication, anthracene offers several advantages over traditional inorganic semiconductor materials. Its organic nature allows for facile synthesis and processing, potentially leading to cost-effective manufacturing processes and versatile device designs. Furthermore, organic semiconductors like anthracene offer compatibility with flexible substrates, opening up possibilities for the development of flexible and wearable electronics.

Diodes are essential electronic components that facilitate the flow of current in one direction while blocking it in the opposite direction. This functionality is crucial in numerous electronic circuits and systems, including rectifiers, signal demodulators, and light-emitting devices. By leveraging the semiconducting properties of anthracene, researchers aim to develop diodes with enhanced performance metrics, such as improved rectification ratios and reduced power consumption.

Naphthalene in Diode Fabrication

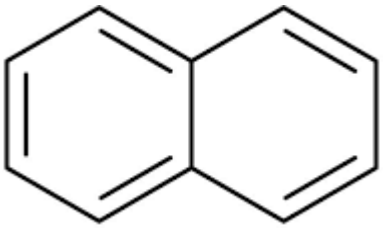


Figure: Structure of Napthalene

Naphthalene, a polycyclic aromatic hydrocarbon consisting of two fused benzene rings, emerges as a promising candidate for semiconductor applications, particularly in the construction of diodes. Its distinctive molecular structure and electronic properties render it well-suited for use in electronic devices, offering opportunities for enhanced performance and versatility.

As a π-conjugated system, naphthalene possesses extended π-electron clouds, enabling efficient charge transport within its molecular framework. This property, coupled with its relatively low energy bandgap, makes naphthalene an attractive semiconductor material. In electronic applications, naphthalene-based semiconductors exhibit favorable characteristics such as high carrier mobility and excellent charge transport properties.

In the realm of diode fabrication, naphthalene presents several advantages over traditional semiconductor materials. Its organic nature facilitates straightforward synthesis and processing, potentially leading to cost-effective manufacturing processes and adaptable device designs. Moreover, organic semiconductors like naphthalene offer compatibility with flexible substrates, enabling the development of flexible and wearable electronics.

Diodes in Semiconductor Electronics

A diode is the simplest and the most basic semiconductor device which acts as a valve to the flow of electrons i.e., for the current. This ensures that the current flows in only one direction. Diodes are of many types like P-N junction Diode, Zener Diode, Schottky diode, Laser Diode, etc. A p-n junction diode or simply diode is an electronic one way valve which is made up of a p-type material in junction with n-type material. A p-type material is formed when a Group 14 element (silicon or germanium) is doped with a Group 13 element (boron, aluminium, etc.) in order to increase the majority charge carriers.

Doping is the process of adding impurities to a pure semiconductor also known as an intrinsic semiconductor. Thus, the process of doping results in the

production of an extrinsic semiconductor (impure semiconductor). As depicted in figure 2(a), a group 13 element, for eg: boron consists of 3 electrons in its valence orbitals however silicon being a group 14 element consists of 4 electrons in its valence orbital. So when the boron enters the lattice of the silicon crystal, its 3 electrons bond with the 3 electrons of the silicon atom the one remaining electron is bonded with an absence of an electron (also known as a hole). This hole is considered a charge carrier in a p-type semiconductor.

An n type material is formed when a group 14 element (silicon or germanium) is doped with a group 15 element (nitrogen, phosphorus, etc.). These group 14 elements are intrinsic semiconductors.

Literature Review

There are several approaches to the development of organic electronics namely the Organic Field Effect Transistors (OFETs) (Allard et al., 2008; Di et al., 2013 F., & Zhu, D. (2012); Perkinson, 2007). Many of the materials and processing would also have to be novel (Jones et al., 2008). There are also several applications for the above mentioned devices (Di et al., 2009; Sokolov et al., 2012; Wang et al., 2017). These includes the likes of biosensors (Guo et al., 2010; Minami et al., 2015; Niu et al., 2023; Raj et al., 2022), non-volatile memory (Baeg et al., 2006), functional bio-layer based devices (Angione et al., 2012), flexible electronics (Liu et al.). In many a cases several different types of materials have been used (Lakshminarayana et al., 2018).

Research Gap

The conventional semiconductors are very expensive chemical compounds. Therefore, in this research the efficiency of organic compounds like Anthracene and Napthelene in their liquid state are experimented to know their efficiency, if used as semi-conductors/ electronic conductors.

Objectives

The objectives of this work are:

- To synthesize high-quality anthracene and naphthalene-based semiconductor materials suitable for diode fabrication.
- To contribute insights into the potential advantages and challenges of using Anthracene and naphthalene in diode technology and their implications for future electronic device design and fabrication.

Hypothesis

It is hypothesized that diodes constructed using anthracene and naphthalene as semiconductor materials will exhibit superior performance characteristics compared to traditional inorganic semiconductor diodes. Specifically, it is anticipated that the organic diodes will demonstrate enhanced rectification ratios, lower leakage currents, and greater flexibility, thereby paving the way for the development of innovative and efficient electronic devices.

Research Methodology

Diode fabrication involved sandwiching anthracene and naphthalene-coated filter paper between copper tape electrodes on a breadboard setup. Electrical characteristics were measured using a Multimeter and varied using a power supply to assess diode performance.

This has been done by making an experimental setup which uses the following materials:

Filter paper	The filter paper acts as the bulk of the chemical used in the experiment.
Copper tape	It acts as the ohmic contacts (electrodes) used to supply power and measure characteristics (voltage and current).
Power supply	It is used to provide potential difference between the two electrodes of the setup.
Multimeters	It is used to measure the voltage and current characteristics of the setup.
Breadboard	It is used to make the connections as required.

These components have been used to determine the V-I characteristics curve of anthracene and naphthalene. The device (made to be a diode) that has been used for containing the chemicals and their reactions has been constructed as explained below.

The copper tape has been used to act as ohmic contacts between the two sides of the diode which will provide the potential difference and the current. The filter papers have been used as the bulk of the chemicals. They had been cut into the shape of the diode and dipped them in the solutions of the respective chemicals. Different number of layers of the filter paper was then inserted in the diode and readings were observed using the multimeters.

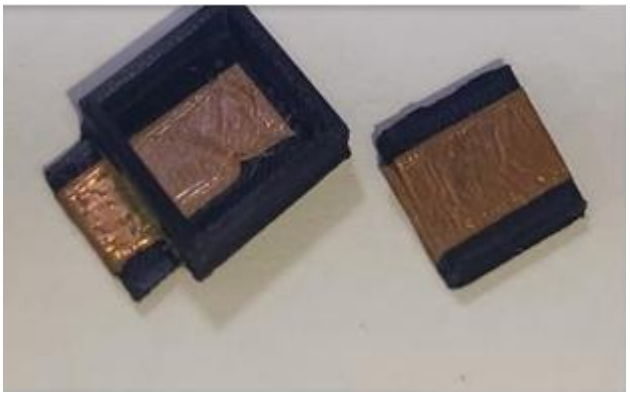


Figure: The Standard 3-D printed diode used in the experiment

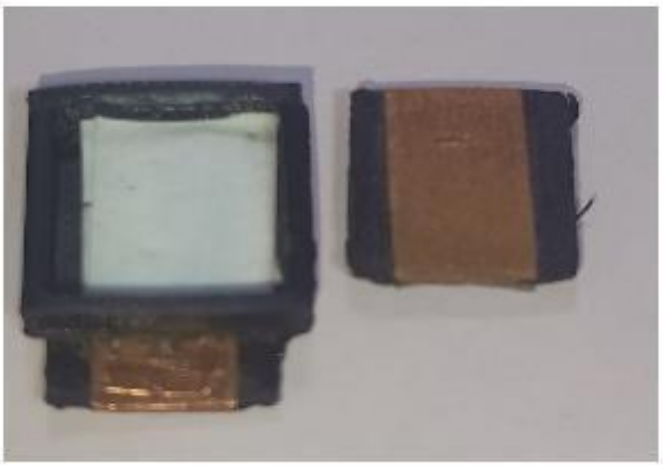


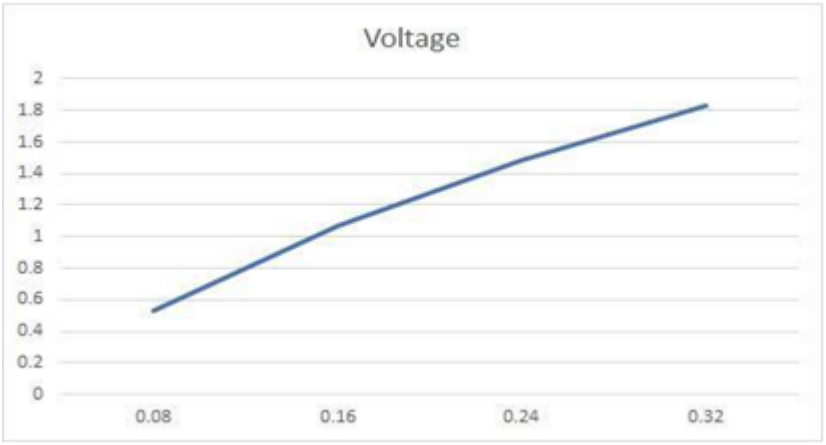
Figure: The diode linked with filter with its lid
Paper soaked in the chemical



Figure: The diode partially closed.

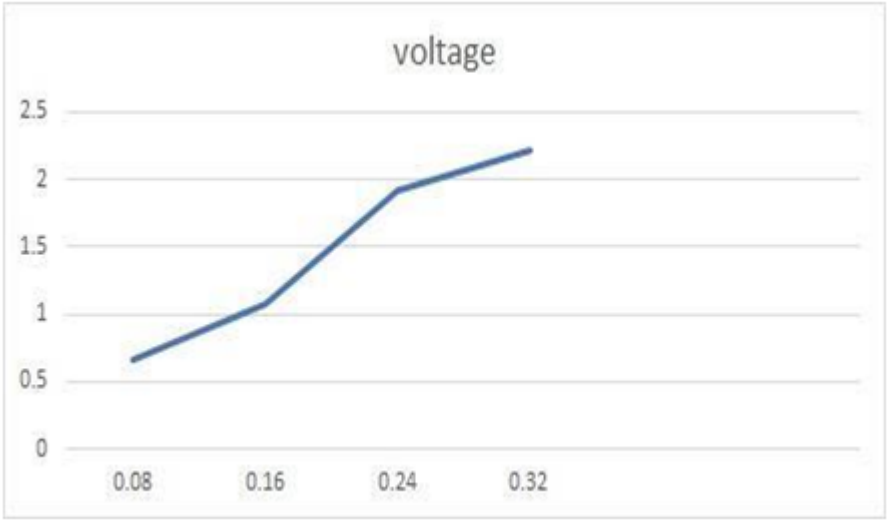
Results

In this study, the electrical characteristics of diodes fabricated using anthracene and naphthalene semiconductor materials, subjected to varying doping concentrations with alcohol. Through a series of experiments, the impact of doping on the current-voltage (IV) characteristics of the diodes has been studied. The observations and results presented herein provide valuable insights into the performance of organic semiconductor diodes and offer potential avenues for optimizing their functionality in electronic applications.



Voltage

Figure: The Forward V-I characteristics of 2 layer of Naphthalene solution with 2 layers of ethanol.



Voltage

Figure (a): The Reverse V-I characteristics of 2 layer of Naphthalene solution with 2 layers of ethanol.

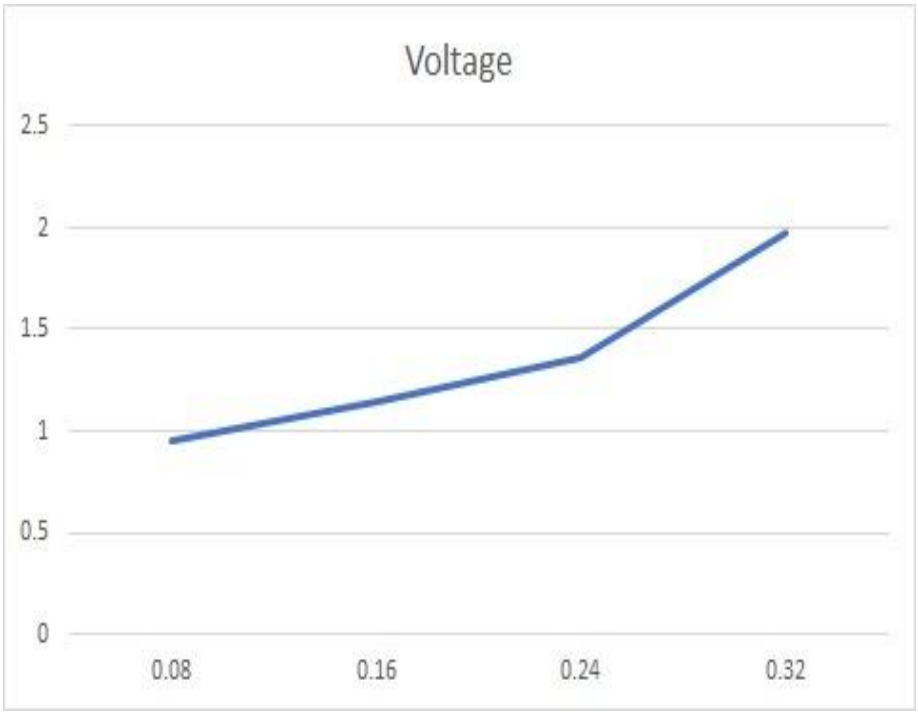


Figure: The Forward V-I characteristics of 2 layer of Naphthalene Solution with 2 layers of ethanol.

In Figure (a), depicting the forward bias characteristics of naphthalene-based diodes, it is observed that the current exhibits a gradual increase with respect to voltage. This behavior suggests a relatively smooth conduction pathway within the diode under forward bias conditions, indicating typical diode behavior.

Conversely, in Figure (b), representing the reverse bias characteristics of naphthalene-based diodes, a distinct phenomenon is observed. Initially, the current incrementally rises at a slow rate as voltage is increased in the reverse direction. However, at a certain voltage threshold, the current sharply increases, indicating a breakdown or avalanche effect within the diode. This sudden surge in current suggests a significant increase in charge carriers and conductivity, possibly due to the breakdown of the depletion region or the onset of tunneling processes.

In Figure (c), depicting the forward bias characteristics of anthracene-based diodes, a similar trend to that observed in naphthalene-based diodes is noted. Initially, as the voltage is increased, the current exhibits a gradual and expected rise, indicating typical diode behavior. However, at a specific voltage threshold, there is a noticeable deviation from this gradual increase, marked by a sudden surge in current.

This abrupt increase in current suggests a transition in the diode's behavior, possibly indicating the onset of a breakdown phenomenon or a change in the charge carrier transport mechanism. Such behavior is significant as it may have implications for the diode's operational limits and reliability in practical applications.

Future Scope

- **Optimization of Doping Strategies:** Further exploration into the effects of doping concentrations and types of dopants, such as alcohol, on the electrical characteristics of Anthracene and naphthalene-based diodes. This could involve systematic studies to identify optimal doping levels for enhancing device performance.

- **Investigation of Breakdown Mechanisms:** Deeper analysis into the underlying mechanisms responsible for the sudden increase in current observed in both forward and reverses bias conditions. This could involve advanced characterization techniques to elucidate the nature of breakdown phenomena and potential strategies to mitigate their effects.

- **Material Engineering:** Continued research into novel materials and fabrication techniques to enhance the performance and reliability of organic semiconductor diodes. This may include exploring alternative organic semiconductor material switch improved stability, charge transport properties, and scalability.

- **Device Optimization:** Further refinement of device design and fabrication processes to achieve better control over diode characteristics such as forward and reverse currents, breakdown voltage, and switching speed. This could involve the development of innovative device architectures and manufacturing methods.

- **Integration in Electronic Systems:** Exploration of potential applications and integration pathways for Anthracene and naphthalene-based diodes in electronic systems. This may include incorporating organic diodes into flexible and wearable electronics, optoelectronic devices, and energy harvesting technologies.

- **Reliability and Longevity Studies:** Comprehensive reliability assessments to evaluate the long-term stability and durability of organic diodes under various operating conditions, including temperature, humidity, and mechanical stress. This could involve accelerated aging tests and reliability modeling to predict device lifespan and failure mechanisms.

- **Scaling for Commercialization:** Scaling up fabrication processes and optimizing production yields to enable the commercialization of organic diode technology. This may require collaboration with industry partners to address scalability challenges and establish cost-effective manufacturing pathways.

Limitations

Lower conduction due to bulkier species. Non polar compounds respond less to external fields but polar compounds are reactive.

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A Study on Consumer Perception towards Online Grocery Shopping

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Abstract

The rapid digitization of retail environments has significantly altered consumer behavior, particularly in grocery shopping. This study explores online grocery shopping and consumer perceptions of this emerging trend through a mixed-methods approach, including surveys and interviews from a diverse sample. Key findings reveal factors influencing consumer attitudes, such as convenience, trust, product quality, price sensitivity, and technological barriers. Demographic variations in preferences are also examined, highlighting the importance of addressing diverse needs within this market.

The study identifies primary drivers of consumer preferences, including convenience and time-saving benefits, while concerns about product freshness, delivery reliability, and privacy act as deterrents. By shedding light on these dynamics, the research offers actionable insights for retailers to enhance their online grocery offerings and improve customer experiences. Additionally, the implications for marketing strategies, technological innovations, and policy interventions are discussed to support the growth and sustainability of the online grocery sector.

This research contributes valuable insights to academia and industry, facilitating informed decision-making and strategic planning in the competitive online grocery market, and enriches the academic discourse on e-commerce.

Introduction

This study explores consumer perceptions of online grocery shopping, exploring into factors influencing preferences, trust, and satisfaction in the evolving landscape of digital retail. Examining the nuances of consumer behaviour, this research aims to uncover the drivers and barriers shaping individuals' attitudes towards online grocery shopping. From convenience and product quality to concerns about privacy and delivery reliability, the study aims to provide valuable insights into the intricate dynamics of this evolving market.

Online shopping has now become popular among the people because of shopping convenience, availability of a product varieties or service, information seeking, and consumer interactions.

By conducting surveys, analysing data, and engaging with participants, this study seeks to unravel the intricacies of consumer decision-making when it comes to online grocery shopping.

The research also intends to shed light on the implications for businesses operating in this space, offering valuable insights for both marketers and policymakers. With the increasing internet availability and rising demand for smart mobile phones and electronic devices. Online groceries shopping took its first steps into world and a few companies emerged offering products at competitive prices and earned consumers trust through a specific short time and assured door to door delivery of their product.

Consumers use the internet not only to buy the products online but also to compare prices or product features and after sale service facilities / rewards and offers they will receive if they purchase the product from a particular store or online store. An online grocery store is a website or platform mostly called mobile applications that allows consumers to purchase food / Groceries over the Internet to be delivered to the person same time or later. Ordering groceries on the Internet is like ordering any other product the preferred groceries items can be searched for specifically, or one can browse through most of them usually charge a delivery fee or token for the service provided, Internet is changing the way customers preserve and buy objects and services and has rapidly evolved proper right into a worldwide phenomenon.by lowering the price of their products and services in case you need to stay ahead in noticeably competitive markets.

Litrature Review

Online shopping services initially did see a fall in the customers but eventually it turned out to be a boon for them. However, the survey's results indicate now consumers have higher expectations for in store safety, there has been reduction in the frequency of in store visits. (Y Wang, R Xu, M Schwarts, D Ghosh, 2020) While customer satisfaction predicts trust for both infrequent and frequent online grocery shoppers, perceived risks fully mediate the effect of trust on repurchase intentions for infrequent online grocery shoppers. (G Mortimer, S Fazal E Hasan, L Andrews, 2016) Another research determined that the subjective norm and perceived usefulness, positively impacted the buying behaviour of customers and vice versa. (Safizal Abdullah, 2016) Guo Jun & et.al. (2017) in their study, Online shopping is an innovative platform to

do business in this competitive world and it is a classic example of the business revolution. Most of the young population preferred to use online shopping to make purchase of their necessities.

Over the years, technology has taken a vast turn. As a boon, almost everything has been made available to people online. Online Grocery being one of them. Many market experts currently feel that online grocery shopping is a profitable concept and will continue to grow in popularity. (Nicola Derrer-Rendall, Alison Attrill, 2016) Ordering groceries online became popular in the 1990s, in the United States, during what has been called the dot-com boom. The popularity was short-lived, however, and several online shopping services faced bankruptcy. (Veiga, 2020)

It was found that price consciousness, convenience, variety and easy payment options were a few impacted to shop online. Factors that influenced the decision of the consumers greatly were found to be perceived risk, perceived cost, perceived convenience and perceived enjoyment. (Ajit Kaushal, 2015).

Research Gap

Within the literature review of our online grocery shopping, the opinion of people wasmajorly missing. Our survey with a variety of questions covering almost every aspect on online grocery shopping gives us some clear answers to the questions, which were not available in the previous literature. We basically got the idea that people are impressed by how online apps have been working with minor issues which is not much of a big deal while making things work online.

Objectives

Our work provides various dimensions of online grocery shopping ranging from its characteristics, its processes, present consumer perception towards online grocery shopping,

- To understand consumer preferences and motivations for using online grocery shopping platforms.
- To identify the factors influencing consumers' choice of online grocery shopping platforms.
- To analyse the perceived convenience and efficiency of online grocery shopping.

- To investigate the level of trust and security concerns consumers have when sharing personal and financial information online for grocery shopping.

- To examine consumers' preferences for additional services such as recipe suggestions, personalized recommendations, or meal planning options offered by online grocery shopping platforms.

- To gather insights on how online grocery shopping has changed consumer behaviour and shopping habits.

Hypothesis

Consumer perceptions significantly influence the adoption and usage of online grocery shopping." This hypothesis aims to investigate whether consumers' perceptions, attitudes, and beliefs about online grocery shopping have a substantial impact on their actual behaviour of using online platforms to purchase groceries. Variables that could be considered while testing this hypothesis might include:

Consumer Perceptions: This could involve factors such as perceived convenience, reliability,trust in online platforms, ease of use, perceived risks (such as privacy concerns or productquality), and overall satisfaction related to online grocery shopping experiences.

Adoption of Online Grocery Shopping: This includes the frequency of using online platforms for grocery purchases, the amount spent online compared to instore shopping, and the intention to continue or increase online grocery shopping behaviour.

Research Methodology

We will target as many populations as we can, as the topic that we have chosen can't be declared just by looking at 4-5 people. Questionnaire focusing on consumer perceptions. Include Likert scale questions to measure attitudes, open-ended questions for qualitative insights, and demographic questions will be asked not just by forms but on one to one and group interviews as well. A study on consumer perception towards online grocery shopping can gather robust data, uncover valuable insights, and contribute meaningful findings to the field of consumer behaviour in e-commerce.

Results

According to our big data the places people mostly are from is:

- Gurgaon
- New Delhi
- Faridabad
- Noida

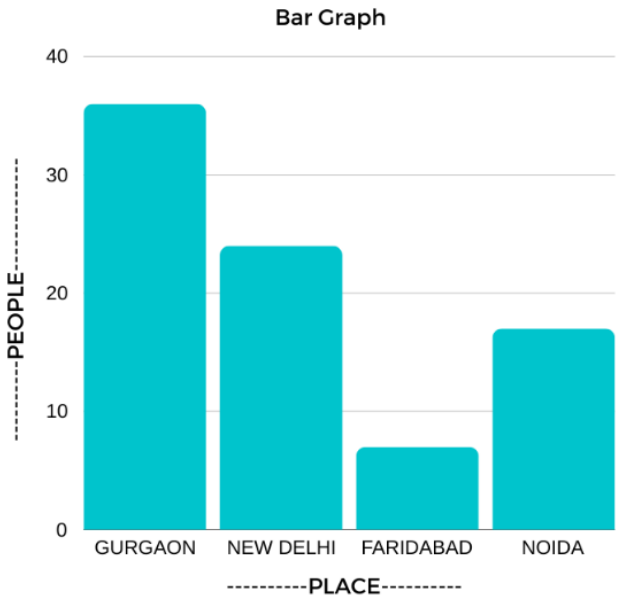


Figure: Places and peoples for Data Collection

So, every answer that we are getting is mostly coming from the people from the locality mentioned above.

Q1) What factors influence your choice of an online grocery store?

According to question number 1 PRICE AND QUALITY are the 2 most important factors As we know the discounts big online grocery platforms are giving are absolutely amazing with the quality as we can order and frozen products such as ice creams Mcains and etc without worrying about the product getting damaged.

Q2) what features do you find most important in a grocery delivery service?

So according to the data presented we got our most important features to be:

1. Fast delivery
2. Range of products
3. Fresh vegetables
4. Long duration of expiry

Each and every point here makes pure sense as we all know leaving the exceptions of source which are always there.

A very important thing is also that not every person has a vehicle or even a shop nearby available so online grocery comes as a true help to each and every one of those.

Q3) what improvements would you like to see in the delivery process of online grocery orders?

According to most of our data the delivery process of the most used delivering apps such as BLINKIT is doing a great job but some of the few factors which still can improve a bit in their sector are

1. . Improved Last-Mile Logistics
2. . Staff to be trained in how to speak to customers and on time delivery
3. . Improvements in the delivery process could include more accurate delivery time estimates, better communication about delays, and options for eco-friendly packaging.

These are one of the most important factors that have a room for improvement.

Q4) Have you ever faced challenges with the user interface or navigation while shopping for groceries online?

So, taking a very important point by Tisha Mazumdar from our data in her exact wording:

Oh, absolutely! I've definitely faced some challenges with the user interface and navigation while shopping for groceries online. Sometimes, it can be a bit confusing to find specific products or navigate through different categories. It would be great if the interface was more intuitive and user-friendly, making it easier to search for items and browse through the store.

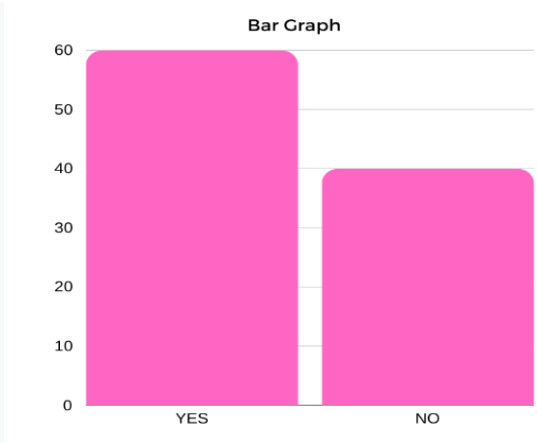


Figure: User responses on facing problems during online shopping

Q5) what are your thoughts on the pricing and discounts offered by online grocery stores compared to traditional ones?

Online grocery stores often strive to offer competitive prices to attract customers. They may have lower overhead costs compared to brick-and-mortar stores, allowing them to be more competitive in terms of pricing

According to the given data we could summarise by saying that of course the online ones gives the better discounts/offers. Traditional ones usually do not have any offers as such until and unless a specific company does that officially.

Q 6) Have you ever considered the environmental impact of packaging when choosing online grocery options?

Most of the people do consider or care about the packaging but they also do know that the better the quality packaging the more is your expense but now days maximum companies like big basket, milk basket, blinkit, etc are providing environmental friendly packaging.

Many consumers consider the environmental impact of packaging when choosing online grocery options. Sustainable packaging and eco-friendly practices are increasingly valued by environmentally conscious shoppers.

Q 7) Do you believe that online grocery shopping has affected your overall food choices or dietary habits?

So, the easy availability of a very wide range of product can lead to both good or bad editions to someone's diet depending on the person, explained very properly by two of the answers from the data given below

1. Online grocery shopping can influence food choices by providing access to a diverse range of products. Some users may find it easier to stick to dietary preferences, while others may face challenges with impulse purchases

2. The convenience of online grocery shopping should ideally be balanced with a commitment to maintaining a healthy diet. Individuals should be mindful of their choices and strive to make nutritious selections.

Q8) In what ways do social media and online communities influence your awareness of new or niche grocery products?

Social media brings inspiration for consumers, as they expose them to diverse opinions, experiences, and trends. I get to try each new product and stick with best one Advertising helps in brand placement and helps in knowing about brand availability These are the reviews of few of the people who are influenced but if we look into a larger data, people are rarely influenced by the social media as the people only want the things they need unlinke the food or item which are seriously branded in such a way that normal people gets fallen into the trap of marketing.

Q9) Can you share any specific challenges or frustrations you've encountered while navigating the online grocery website or app?

Few of the most important challenges faced by people which needs to be resolved as soon as possible is

1. Poor Website Performance Time is the most important factor and if a website takes a lot of time to load, then the individuals will shift to the competitors' site and the online grocery business will lose its sales
2. Restrictive payment options are inconvenience
3. Cluttered and laggy interface.
4. Specific challenges I've encountered while navigating online grocery websites or apps include difficulty finding specific items, slow loading times, and confusing search filters.
5. One challenge I've encountered while navigating online grocery websites or apps is when the search function doesn't work as expected. Sometimes, I'll search for a specific item, but the results will show unrelated products or not display the item I'm looking for at all. It can be frustrating when you have a specific item in mind and it's difficult to find it quickly.

Another challenge is when the website or app is not user-friendly and it's hard to navigate through different categories or sections. It's important for online grocery platforms to have a smooth and intuitive interface to enhance the shopping experience.

These were few of the most important challenge faced by the people

Q10) What improvements, if any, would you suggest for enhancing the search and filter options when looking for specific grocery items?

1. Make it easy to navigate a specific item weather by search or by suggestions box on the platform
2. Make results more relevant, improve the value of results, give the customer more control offering a more seamless experience.
3. There should be specific section when festivals arrive
4. Online groceries store should provide flat forms and website specifically for searching which will help the customers to have what they are looking for directly
5. Improving search and filter options could involve implementing predictive search suggestions, refining category filters, and allowing for more customization based on dietary preferences or restrictions.

Q11) Have you experienced any issues with the accuracy of product information or images, and how do you think this could be improved?

Image recognition technology to automatically identify and match product images with corresponding product listings, minimizing errors and ensuring consistency.

The first thing a customer sees when they search for a product online is the image. It needs to have good clarity.

Issues with the accuracy of product information or images can be improved by ensuring regular updates, verifying product details from reliable sources, and providing user-generated content like reviews and photos.

Users may face issues with inaccurate product information or images. Implementing rigorous data verification processes and user feedback mechanisms can help improve accuracy.

(Q12) How would you rate the responsiveness and effectiveness of customer support when addressing issues related to your online grocery orders?

1. Here are the few reviews of the people from our responses which explains this question in the best possible way
2. Oh, I totally get you! The responsiveness and effectiveness of customer support can vary. In my experience, it's been a bit hit or miss. Sometimes

they're super quick to respond and resolve the issues, while other times it takes a bit longer.

3. Oh, let me think about that... In my personal experience, I would rate the responsiveness and effectiveness of customer support for online grocery orders as pretty good. Whenever I've had an issue or needed assistance, they've been quick to respond and helpful in resolving the problem.
4. Follow-up after the issue has been addressed can further enhance the customer's perception of the support experience, ensuring that they are satisfied with the resolution.
5. All the people left have also rated the responsiveness and effectiveness of customer support when addressing issues related to your online grocery orders above average leaving few who rated below 5 so of course there is a room for improvement but all in all they are doing a great job.

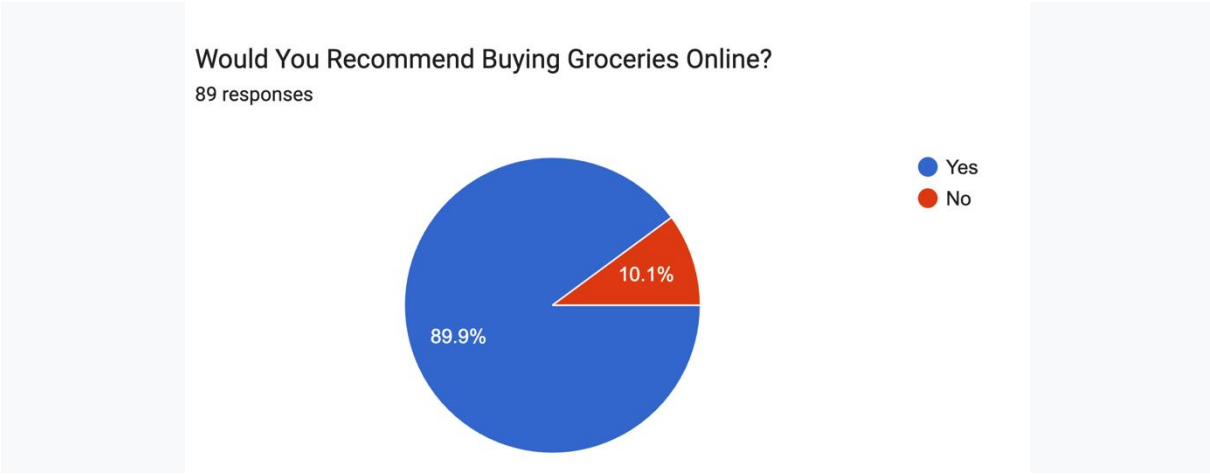


Figure: Recommendation on buying online groceries

Discussion

Life can get super busy, especially when we had to stay home more. That's why many of us have started to shop for groceries online—it's just very convenient and saves a ton of time. But there are many ways which makes us choose online grocery.

In our team discussions, prompted by feedback from an internal survey, it was revealed that, akin to the findings of Morganosky and Cude (2000), convenience and time-saving benefits significantly influence individuals opting for online grocery shopping [1]. Comprising diverse demographic, including young professionals and busy parents, our team collectively appreciates the seamless integration of online shopping into our dynamic lifestyles.

Furthermore, research by Hand et al. (2009) indicates that pivotal life events, such as childbirth or health-related challenges, often propel individuals towards online grocery shopping, a sentiment echoed within our team discussions [2]. Many team members shared anecdotes detailing how such personal circumstances initiated their foray into online grocery shopping, providing invaluable assistance during demanding or tumultuous periods.

The imperative of feeling secure and placing trust in online purchases was underscored by Mortimer et al. (2016) [3]. Our team extensively deliberated this aspect, emphasizing the paramount importance of website credibility and product quality assurance. We rely heavily on user reviews, ratings, and the reputation of online vendors to ensure satisfaction with our purchases. Additionally, the role of customer service emerged as a salient factor in our discussions, aligning with findings by Singh and Söderlund (2020) [6]. Exploring the various avenues through which online grocery shopping enhances consumer satisfaction, as highlighted by Anckar, Walden, and Jelassi (2002), prompted our team to contemplate the diverse business models impacting our shopping encounters [7]. Hansen's (2008) examination of the influence of personal values and attitudes on the willingness to engage in online grocery shopping resonated with our team [8]. This prompted reflective discourse on the alignment between our individual values and online shopping preferences, fostering deeper introspection into our underlying motivations. Delving into the acceptance of online grocery shopping, Chien, Kurnia, and von Westarp's (2003) study underscored the significance of platform visibility in driving consumer adoption [9].

Lastly, Pitts et al. (2018) illuminated both the benefits and challenges of online grocery shopping, particularly concerning food and beverage purchases [10]. Their findings sparked discussions within our team on strategies to mitigate challenges and make informed decisions, particularly regarding the procurement of perishable items.

Conclusion

Based on the data collected from respondents primarily located in Gurgaon, New Delhi, Faridabad, and Noida, several key insights emerge regarding their preferences and experiences with online grocery shopping. The most influential factors guiding their choice of online grocery stores are price and quality, with respondents appreciating the competitive pricing and assurance of product quality offered by major online platforms. Key features valued in grocery delivery services include fast delivery, a diverse range of products, availability of fresh vegetables, and longer expiry durations, catering to the convenience and varied needs of customers.

While acknowledging the efficiency of delivery services provided by popular apps like Blinkit, respondents highlighted areas for improvement, including enhanced last-mile logistics, better-trained staff for customer interactions, and improved communication regarding delivery timings and eco-friendly packaging options. Challenges with user interface and navigation were also noted, emphasizing the importance of intuitive and user-friendly platforms to streamline the shopping experience. Respondents overwhelmingly favoured online grocery stores for their competitive pricing and discounts compared to traditional brick-and-mortar stores.

Environmental considerations, such as sustainable packaging, were noted as increasingly important factors for consumers when choosing online grocery options. Additionally, respondents recognized the influence of online grocery shopping on their dietary habits, stressing the importance of maintaining a balance between convenience and healthy choices. While social media and online communities play a role in product awareness, the influence on actual purchasing decisions was deemed relatively low. Overall, these insights provide valuable perspectives for both online grocery retailers and service providers seeking to optimize their offerings to meet customer needs in the evolving landscape of digital shopping.

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Identity and Access Management

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Abstract

In the ever-expanding domain of the Internet of Things (IoT), companies are confronted with an increasingly complex array of challenges pertaining to the management of access to their systems. These challenges, arising from diverse sources such as escalating security threats, the inherent limitations of IoT devices, interoperability hurdles, and the imperative for scalable solutions that traditional approaches struggle to adequately address, underscore the critical need for innovative strategies. Blockchain technology has emerged as a compelling contender in this arena, offering potential solutions to these pressing concerns. This paper endeavours to elucidate the multifaceted applications of blockchain within the realm of Identity and Access Management (IAM) for IoT ecosystems, elucidating how this disruptive technology can effectively tackle the multifarious challenges encountered therein. It embarks upon a comprehensive exploration of the deployment of private blockchains as a means to institute tamper resistant IAM functionality, while simultaneously ensuring scalability to accommodate the burgeoning volume of clients and transactions. By leveraging private blockchains, organizations can fortify their defenses against single points of failure, while also facilitating transparent auditing and monitoring of security events, thereby enhancing overall system integrity. Moreover, as the paradigm of edge computing assumes increasing prominence, particularly within the Industrial Internet of Things (IIoT), it introduces a fresh set of security vulnerabilities that necessitate innovative mitigation strategies. In response, this paper proposes an integrated approach that seamlessly integrates blockchain-based identity management with sophisticated access control mechanisms tailored specifically for edge computing environments. This holistic strategy encompasses the utilization of self-certified cryptography for robust entity registration and authentication, alongside the establishment of resilient identity and certificate management mechanisms on the blockchain ledger. Furthermore, it introduces a novel access control framework underpinned by Bloom filters, complemented by the development of a lightweight secret key agreement protocol designed to facilitate secure communication among resource-constrained edge devices. Through the synergistic deployment of these advanced measures, the paper endeavours to furnish organizations operating within IIoT ecosystems with comprehensive assurances of authentication, auditability, and confidentiality, thereby

engendering a climate of heightened data security and resilience. Ultimately, these innovative strategies serve to fortify the foundations of IoT deployments, fostering a future landscape characterized by enhanced security, interoperability, and trustworthiness.

Introduction

In our everyday lives, we often share our identity, and Identity and Access Management (IAM) refers to the process of managing identities by obtaining, verifying, and protecting them. IAM has advanced over time, from simple usernames and passwords to advanced biometrics like fingerprints and retina scans. Among these, the Self-Sovereign Identity Model is noteworthy, as it allows users to manage their identities independently without third-party involvement, using blockchain technology.

Blockchain is a public, distributed ledger that stores data in a secure and unchangeable manner. It was first introduced in 2008 with Bitcoin and has since gained popularity due to its decentralized and secure features. This technology has the potential to enhance the security of identity management systems by providing a secure repository for personal information.

The Internet of Things (IoT) has become increasingly prevalent in recent years, with predictions that over 100 billion devices will be connected by 2045. The Industrial Internet of Things (IIoT) is a significant aspect of Industry 4.0, aiming to improve efficiency and competitiveness by integrating sensors, controllers, and advanced information technology in industrial processes. However, the vast amount of data generated by these devices poses challenges for traditional cloud computing infrastructure, leading to the emergence of edge computing.

Edge computing, which uses computing and storage resources closer to users, addresses the limitations of network bandwidth and latency, making it ideal for mobile computing and IIoT applications. However, security remains a concern in edge computing due to the diverse network environment and the proliferation of intelligent manufacturing terminals that are prone to security vulnerabilities.

Blockchain technology, known for its ability to achieve consensus in distributed environments without intermediaries, has the potential to enhance security and privacy in the IoT domain. This paper proposes developing an identity management and access control mechanism tailored for edge computing in IIoT environments using blockchain technology to ensure data security. The paper will explore related works in intelligent manufacturing and

IIoT, analyse existing data security challenges in IIoT, and detail the construction of the proposed identity management and access control mechanism based on blockchain technology. Finally, conclusions drawn from this research will be presented in the concluding section.

Literature Review

Adireddy, Gottapu, and Aravamudhan (2016) introduced a user-focused method for managing access to Internet-of-Things (IoT) devices in their paper "User-centric federation of access to Internet-of-Things (IoT) devices: A valet key for IoT devices. “The authors recognized the complexities involved in managing access to IoT devices, which include multiple users, devices, and applications. To address these complexities, they proposed a user-cantered strategy that allows users to control access to their IoT devices through a "valet key" metaphor. This valet key is a digital token managed by the user, enabling them to grant temporary access to their IoT devices to other users or services without surrendering full control. The authors demonstrated the effectiveness of their approach through a prototype implementation, highlighting its potential for flexible and secure IoT device access management. The paper contributed to the discussion on IoT device access control, an essential aspect given the growing prevalence of IoT technologies.

Azaria, Ekblaw, Vieira, and Lippman (2016) created a blockchain-based system called “MedRec" to manage electronic medical records (EMRs) in their research paper. They recognized the complexities involved in EMR management, which includes various stakeholders like healthcare providers, patients, and regulators. To address these challenges, they proposed MedRec, a platform that uses blockchain technology to ensure secure and transparent access to EMRs.MedRec records all transactions related to EMR access and permission management on a blockchain ledger. This gives patients detailed control over who can access their medical records and for what purposes. The authors demonstrated the effectiveness of MedRec through a prototype implementation. This contributes to the growing research on blockchain-based solutions in healthcare, which is crucial given the rapid increase in healthcare data.

Babar, Mahalle, Stango, Prasad, and Prasad (2010) wrote a paper called "Proposed Security Model and Threat Taxonomy for the Internet of Things (IoT)." They presented a security model and threat classification designed specifically for the Internet of Things (IoT). Recognizing the unique security challenges faced by IoT devices, such as gaps in user awareness, resource limitations, and extensive attack surfaces, the authors advocate for a comprehensive security strategy. Their proposed security model integrates

access control, encryption, and secure communication protocols to enhance the defences of IoT devices. The authors also introduce a threat taxonomy tailored to IoT devices, covering physical, network, and software threats. This taxonomy serves as a structured framework for identifying and addressing potential security vulnerabilities within IoT systems. This paper contributes to the growing body of literature on IoT security, which is a critical issue given the rapid expansion of IoT devices.

Wang, Cao, Simon, and Park (2018) proposed an enhanced ant colony optimization (ACO) algorithm specifically designed for wireless sensor networks (WSNs) with mobile sinks. The authors acknowledged the hot spot problem in conventional WSNs, where sensor nodes near static sinks experience increased traffic loads and energy depletion. To address this, they introduced a mobile sink strategy, where the sink moves dynamically through the network, directly communicating with designate-d nodes, such as cluster heads (CHs), for efficient data collection. The main challenge was determining the- optimal mobility trajectory for the mobile sink to maximize- energy efficiency. To tackle this, the authors developed an improved ACO algorithm that considers CH distance-s to determine the- optimal mobility trajectory. The network is divide-d into clusters, with each cluster having a CH.

Wang, Deng, and Wang (2019) introduce an innovative way to improve the security of wireless sensor networks (WSNs) by enhancing the internal hardware design of sensor nodes in their paper titled "Enhancing Sensor Network Security with Improved Internal Hardware Design. “The authors recognize the common security issues faced by WSNs due to their limited resources and vulnerabilities in wireless communication. To address this, they propose a novel internal hardware design for WSN nodes. This design incorporates a security prediction and control program, backed by big data analysis, to proactively anticipate and prevent potential security threats. The core of their approach is the "network security line" concept, which simplifies security measures based on changes in network security before and after an attack. Additionally, the program integrates various topology security measurement models based on stochastic processes to evaluate the WSN's topology security. Through extensive experiments, the authors demonstrate the effectiveness of their proposed design in enhancing the overall security of wireless sensor networks.

Augot et al. (2017) have proposed an innovative system that transforms in-person identity verification into an anonymous digital identity using the Bitcoin blockchain. The authors criticize centralized identity management systems for being vulnerable to data breaches and surveillance, and advocate for a decentralized approach based on the Bitcoin blockchain. The system

consists of three main stages: initial face-to-face identity verification with a trusted third party, creation of a digital identity signed by the third party's private key, and the encryption and storage of this identity as an anonymous entity on the Bitcoin blockchain. The key benefits of this system over traditional systems include decentralization, elimination of single points of failure or control, anonymity for user authentication without revealing real-world identity, and enhanced security through encryption and blockchain storage. Augot et al. (2017) present a prototype implementation of the system, supported by performance evaluations.

Augot et al. (2017) propose a user-friendly system to manage verified identities on the Bitcoin blockchain. This system aims to transform decentralized identity management across various sectors like voting, healthcare, and e-commerce. The system has three main parts: a user-friendly identity management system, a Bitcoin-based notary service, and a verification service. Users can create and manage their identities using the identity management system, and these identities are securely stored on the Bitcoin blockchain. The notary service generates proof that these identities exist on the blockchain, and the verification service checks this proof to verify the identities. Augot et al. highlight several benefits of their system over traditional options. These include decentralization, user control, and security from the Bitcoin blockchain's tamper-proof and unchangeable nature. They have built a prototype of the system and shown that it works well with minimal overhead.

Augot et al. (2017) presented a system focused on user needs for verified identities on the Bitcoin blockchain. This was published in the Data Privacy Management, Cryptocurrencies and Blockchain Technology: ESORICS 2017 International Workshops. Their system aims to revolutionize how identity is managed in a decentralized way across different areas. Schanzenbach, Bramm, and Schutte (2018) introduced reclaim ID, a secure and self-sovereign identity management system. It uses name systems and attribute-based encryption. Their work was published in CoRR and is available online.

Schanzenbach and colleagues (2018) developed a system called reclaimID that enables secure and self-managed digital identity management. By using name systems and encryption based on user attributes, the system ensures privacy and security for people's personal data. This addresses the issues with centralized identity management systems controlled by large organizations, which often lead to security vulnerabilities and a loss of user data control. The paper evaluates reclaim ID's security and privacy features, demonstrating its resilience against threats like phishing, identity theft, and surveillance. The authors reference decentralized identity management systems that use blockchain technology, such as Sovrin and uPort. However, they argue

that reclaimID offers better privacy protection due to its use of attribute-based encryption. The paper builds on previous work on attribute-based encryption, a technology applied in diverse applications to enhance data security and privacy. Ourad, Belgacem, and Salah (2018) developed a blockchain-based system to manage access control and authentication for the Internet of Things (IoT). This system aims to address the limitations of traditional mechanisms, such as scalability, security, and privacy concerns. The system has three main parts:1. A blockchain-based access control and authentication management system2. A smart contract-based access control mechanism3. A decentralized identity management system. The first part manages policies and credentials, while the second enforces those policies and handles access requests and revocations through smart contracts. The third part allows users to manage their identities and personal information. The authors claim this system offers advantages in terms of decentralization, scalability, security, and privacy compared to traditional methods. A prototype implementation and performance evaluations have confirmed the system's ability to handle access requests with minimal overhead.

Luong and Park (2023) presented a blockchain-based system to manage user identities while preserving privacy. They used Zk-SNARK technology to address issues like centralized control, data breaches, and privacy concerns in traditional identity management systems. The system has three main components: a user identity management system, a blockchain-based identity verification system, and a privacy-preserving mechanism using Zk-SNARK.Similarly, Mikula and Jacobsen (2018) proposed a blockchain-based identity and access management system for electronic healthcare records. This system aimed to tackle problems like data breaches, identity theft, and privacy violations. It includes three primary components: a blockchain-based identity and access management system, a smart contract-based access control mechanism, and a decentralized identity management system. Both studies highlight the potential of blockchain technology in enhancing identity and access management. While Luong and Park (2023) focused on privacy preservation, Mikula and Jacobsen (2018) proposed a solution for the healthcare sector.

Liu et al. (2020) reviewed blockchain-based identity management systems (IDMSs) in depth. They discussed the problems with centralized IDMSs and how blockchain technology can create decentralized, secure, and private identity solutions. The authors examined various blockchain-based IDMSs, including public, consortium, and private blockchains, and looked at their features and limitations. They also addressed challenges like scalability, interoperability, and regulatory compliance, and provided insights on the future of blockchain based IDMSs. Ren et al. (2019) proposed a blockchain-based

IDMS for the industrial Internet of Things (IIoT) using edge computing. Their goal was to tackle the scalability, security, and privacy issues of traditional IDMSs. By combining blockchain and edge computing, they were able to provide secure and efficient identity management and access control for IIoT devices. They demonstrated the feasibility and effectiveness of their system through implementation and evaluation. Mikula and Jacobsen (2018) suggested a blockchain-based...

Liao et al. (2022) have proposed an innovative blockchain-based framework to enhance identity management and access control in open banking systems. This framework enables users, service providers, and the system itself to interact with greater efficiency and security. The authors' implementation and evaluation demonstrate the framework's potential, while their comparison to existing solutions highlights its advantages. The paper offers valuable insights for addressing the scalability and regulatory challenges faced by similar blockchain applications.

Mohammed (2021) presents a blockchain-based solution for identity and access management, addressing the shortcomings of traditional systems. By leveraging blockchain technology, the proposed system offers decentralization, security, and transparency in managing digital identities and access control. The system consists of three main components: user identity management, service provider management, and blockchain-based identity and access management. This comprehensive platform enables secure identity verification and access control. The private blockchain network ensures integrity and security through a consensus algorithm, with each node maintaining a copy of the blockchain. The key benefits of the proposed system include decentralization, eliminating single points of failure, security through cryptographic techniques, and transparency via recorded transactions on the blockchain. The implementation and evaluation demonstrate the system's efficiency, scalability, and security, surpassing existing approaches.

A. Related Work

Over time, blockchain technology has been investigated for applications beyond cryptocurrency, with identity and access management being one notable area of exploration. Blockchain holds promise as a driver for advancing our systems towards self-sovereign identity. Noteworthy endeavors in this domain are elaborated upon below. It's crucial to emphasize that a decentralized data management system ensures users maintain ownership and control over their data, eliminating reliance on third-party entities and safeguarding privacy. In data management, blockchain transactions execute tasks like storing and retrieving data, offering users fine-grained access control and the ability to

revoke permissions as needed. However, performance issues arise in data processing within such systems. For instance, a distributed identity and access management system utilizing blockchain technology is being developed for healthcare record maintenance, employing Hyperledger Fabric. This system directs access to a backend server housing patient healthcare data through a distributed identity and access management system built on Hyperledger Fabric. Blockchain facilitates identity verification and secure information transmission, enhancing system decentralization, resilience against unauthorized access, and tamper resistance. Another proposed model revolves around a blockchain-based ID that can be authenticated by third parties and contains pertinent individual information. An accompanying secure app allows users to sign documents and verify their identity. Notably, the use of signatures and hashes is leveraged to disclose only necessary identification details. Furthermore, a key distribution system named BIBE is under development, integrating identity-based encryption with blockchain technology to mitigate Key Generation Center (KGC) unauthorized intrusions. This approach involves establishing the Key Generation Center on the blockchain with assistance from multiple nodes, particularly three, with node responsibilities regularly rotated to minimize assault impact. Additionally, their architecture incorporates timestamps, random numbers, and hash algorithms to reduce the likelihood of network unauthorized intrusions.

B. The Fundamental Concepts

To understand our topic, it's essential to know some concepts:

- **Blockchain:** Created by Satoshi Nakamoto in 2001 for Bitcoin, blockchain is a decentralized, tamper-proof digital ledger. It consists of linked blocks containing timestamped data and is maintained by a network of nodes. Blockchain uses cryptographic hashing to ensure data integrity and employs consensus algorithms like proof-of-work to add new blocks.

- **Hashing:** A process that derives a value from an unstructured string or text, typically using a hash function. Cryptographic hash functions are a subset with unique properties, making them suitable for cryptography. Hashing is used in blockchain technology to ensure the chain's integrity.

- **Proof-of-Work (POW):** The consensus algorithm used in blockchain networks, such as Bitcoin and Ethereum, to add new blocks. PoW grants the privilege of adding a new block to the first node to solve a complex mathematical problem. It ensures the blockchain's security, as compromising it requires more than 50% of the processing power across all nodes.

- **Smart Contracts:** Self-executing, self-verifying, and tamper-resistant pieces of code that contain specific logic. Once deployed on the blockchain, no one can alter their operations. They eliminate the need for third-party intermediaries by automating the execution of certain activities based on predefined conditions.

- **Self-Sovereign Identity:** A concept that emphasizes user ownership and control over their identity. It differs from traditional identity models that rely on third-party servers to store sensitive identification information. Self-sovereign identity enhances security by decentralizing identification information and giving users complete control over their data. This reduces the impact of attacks aimed at stealing user credentials and eliminates the costs associated with maintaining a centralized server.

Research Gap

Identity and Access Management (IAM) systems have become more advanced, but a major challenge is integrating them with cutting-edge technologies such as blockchain, artificial intelligence (AI), and machine learning (ML). Research has highlighted the benefits of these technologies in IAM – blockchain for secure data storage, AI for efficient user authentication, and ML for immediate threat detection. However, there is a lack of understanding on how these technologies collaborate within an IAM framework. We need studies on their combined impact, interactions, synergies, and possible risks. Additionally, there is limited real-world evidence on implementing these technologies.

Objectives

This research aims to address the lack of comprehensive user-centric identity management frameworks for blockchain-enabled environments. The objective is to develop a theoretical model for a Self-Sovereign Identity (SSI) system, leveraging blockchain's decentralization and cryptographic mechanisms to enhance individual control over personal information while ensuring compliance with privacy regulations. The proposed model will integrate concepts of user consent, granular access control, and data minimization with a focus on usability and interoperability.

Hypothesis

The use of blockchain technology can significantly improve security, privacy, and efficiency in identity and access management compared to

traditional centralized systems. Blockchain's decentralized nature reduces the risk of unauthorized access and breaches by eliminating a single point of control. The immutable blockchain records ensure the integrity of identity and access data, preventing any tampering or unauthorized changes. Cryptographic security mechanisms in blockchain-based identity systems also provide strong protection of sensitive user information, safeguarding confidentiality and privacy. Additionally, the streamlined and automated processes enabled by blockchain technology are expected to increase operational efficiency, lowering administrative overhead and enhancing the user experience. Therefore, adopting blockchain-based solutions can offer substantial benefits for identity and access management.

Research Methodology

The research method for examining the effectiveness of blockchain-based identity and access management systems involves a multi-stage approach. First, a thorough literature review will be conducted to understand existing research on blockchain technology, identity and access management systems, and related topics. This will provide a solid foundation for the study. Next, empirical research methods like case studies, experiments, and surveys will be used to gather primary data and insights from real-world implementations of blockchain-based identity and access management systems. The case studies will involve an in-depth analysis of specific organizations or projects that have implemented such systems, focusing on their experiences, challenges, and outcomes. Surveys and interviews with relevant stakeholders, such as system administrators, end-users, and industry experts, will also be conducted to collect first-hand perspectives on the performance, benefits, and limitations of the blockchain-based solutions. The data gathered from these empirical studies will be analysed to validate the research hypothesis and draw meaningful conclusions. Finally, the findings from the literature review and empirical research will be synthesized to develop a comprehensive understanding of the effectiveness of blockchain-based identity and access management systems. This will inform recommendations for the adoption, implementation, and further development of these technologies.

Results

The analysis of the findings revealed 136 studies from various healthcare-related fields that met the criteria for conclusive examples. The majority of the studies were interdisciplinary, making it difficult to categorize them into distinct research zones. The three identified research zones correspond to three stages of blockchain (BC) in the healthcare life cycle: idea

generation, dissemination, and implementation. The review of the documents identified significant themes that current research addresses and potential areas for future and ongoing advancement. By utilizing the IPO framework, the findings were organized to emphasize commercial issues rather than technological arrangements.

Conclusion

This paper introduces a blockchain-driven approach to authenticate users securely for accessing IoT devices, addressing the limitations of existing authentication methods. By utilizing Ethereum smart contracts, tamper-proof records and decentralization are achieved, enhancing security and reliability. Real-world scenarios with IoT devices validate the effectiveness of this solution in authenticating users and resisting malicious attacks. Future plans include scaling the approach for a large number of IoT devices and users, testing on the Ethereum blockchain network for performance evaluation, and exploring monetization aspects using crypto tokens like ether for IoT device usage payments.

This research delves into the integration of identity and access management within blockchain technology, focusing on Ethereum. It highlights how identity management systems streamline digital identity administration and authentication processes. Blockchain's cryptographic nature ensures mutual verification and data integrity, supported by the use of web3js for creating and validating signatures. Recent advancements in cryptocurrency network security promote self-sovereign identity, empowering users to manage their identities securely. The study underscores blockchain's technological advantages in securing and ensuring the reliability of system data through smart contracts that enforce user data integrity rules.

The Internet of Things (IoT) faces significant challenges in security and management without a foundation of trust. Industries seek robust IAM solutions to safeguard their networks from evolving threats. This paper proposes a blockchain-based Public Key Infrastructure (PKI) IAM for IoT, offering a resilient alternative to traditional CA servers. By leveraging blockchain's distributed architecture, this solution enhances security and eliminates the need for centralized servers, backups, and maintenance, paving the way for a more secure and scalable IoT environment.

Limitations

Utilizing Blockchain and smart contracts for access control offers several benefits, including enhanced data and service integrity, increased availability,

public availability of code and data, and immutable rules and policies. The system's availability is guaranteed by eliminating the single point of failure, making certain attacks like DDoS impossible. Additionally, access traceability is improved, and service costs are reduced by removing the need for a third party. However, similar to authentication methods, these approaches can be problematic for resource constrained devices like IoT. Adjusted consensus models can decrease resource consumption but may negatively impact Blockchain security. Proposing auditable access control methods can also violate user privacy.

Some studies have used Blockchain as a database for storing rules and policies instead of access management processes, which may result in inheriting the conventional methods' problems, such as single points of failure. Scalability remains a significant issue, with performance potentially impacted by oversized chains, leading to increased synchronization times for new users. Therefore, research interests include protecting user privacy while maintaining access control auditability, decreasing resource consumption, removing central authorities through fully distributed access control mechanisms, and addressing scalability issues, particularly for IoT environments.

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Green Entrepreneurship Education: A Case of GD Goenka University in India

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GD Goenka University

Abstract

Green entrepreneurship plays a crucial role in driving innovation and fostering sustainable development, helping to create a more environmentally conscious and socially responsible economy.The study draws upon these interconnected themes of sustainability, entrepreneurship, consumer behaviour, educational institutions, government policies, and green product innovation to explore the landscape of green entrepreneurship within GD Goenka University students. The aims of the study are 1) to measure the current awareness levels of green entrepreneurship among students in the university 2) to evaluate the extent of knowledge about various government startup schemes among students and 3) to explore the attitudes, perceptions, and interests of students towards green entrepreneurship and government startup schemes, and also 4) to identify the key factors influencing the awareness and engagement of students in green entrepreneurship and government startup schemes. The study is a quantitative type with a sample representative (N = 284 students, valid N = 2782) from the University and the variables were conducted with the help of a Likert-type for analysis and interpretation of the study.

Key words: sustainability, education, awareness, entrepreneurship, educational institutions, GD Goenka University (GDGU)

Introduction

The increasing global alarm regarding climate change and sustainable development has triggered a significant transformation in the Indian markets. Present-day consumers prioritize environmentally friendly products over conventional ones, demonstrating a burgeoning sense of environmental and social responsibility. This shift has fuelled innovation and redesigning efforts among individuals and organizations, capitalizing on the evolving Indian market landscape. Green entrepreneurship involves creating and running businesses that focus on sustainability and environmental consciousness. These entrepreneurs are dedicated to developing products, services, and business practices that have an impact on the environment. In contemporary times, green entrepreneurs place emphasis on utilizing renewable energy sources,

minimizing waste and carbon emissions, and advocating for eco-friendly practices across their operations.

Green entrepreneurship in India is gaining momentum as more and more individuals and businesses are recognizing the importance of sustainability and environmental conservation. Entrepreneurs are coming up with innovative ideas and solutions to address environmental challenges while also creating profitable business opportunities. From renewable energy projects to eco-friendly products and services, green entrepreneurs in India are making a significant impact on the economy and the environment. The government is also supporting green initiatives through policies and incentives, encouraging more entrepreneurs to invest in sustainable businesses. With a growing awareness of climate change and the need for sustainable development, green entrepreneurship is playing a crucial role in shaping a greener and more sustainable future for India.

These items are crafted utilizing materials and methods that prioritize environmental preservation, aiming to minimize harm to the planet.From biodegradable packaging to products made from recycled materials, green products offer a way for consumers to make more conscious choices that support sustainability. By opting for green products, individuals can reduce their carbon footprint and contribute to the preservation of the Earth's natural resources. Additionally, many green products are of high quality and innovative design, dispelling the myth that sustainable options are inferior. Embracing green products is not only beneficial for the environment but also for personal health and well-being, making it a win-win choice for both individuals and the planet.

A group of students of from GD Goenka University, a private institution in north region India, conducted a survey from students participation from various schools/departments as SOES (School of Engineering), SOM (School of Management), UID (United World Institute of Design), B.A. English, and SOL (School of Law) to understand the prevalence of green entrepreneurship among these schools. An empirical survey was conducted. The survey encompassed students, aiming to gauge their awareness and involvement in green initiatives and sustainable practices.

Theoretical Background of the Study

The theoretical background for the research paper on green entrepreneurship within GD Goenka University schools encompasses several key concepts and frameworks related to sustainability, entrepreneurship, and educational institutions' role in fostering green initiatives. The concept of green

entrepreneurship is grounded in the principles of sustainability and environmental consciousness.

The theoretical background of the research paper draws upon these interconnected themes of sustainability, entrepreneurship, consumer behaviour, educational institutions, government policies, and green product innovation to explore the landscape of green entrepreneurship within GD Goenka University schools and its implications for the Indian market.

Literature Review

Yashwant and Veena (2021) The study was analysed, focusing on the emergence of green entrepreneurship and its significance within the Indian context. According to their findings, green entrepreneurship offers promising prospects for sustainable development, fostering hope. Moreover, the study highlights the growing consumer consciousness regarding the environment and eco-friendly products, which has embedded green principles into business models, serving as a competitive advantage.

Parminder and Surinder (2023) The study examines green entrepreneurship and its components, investigating the correlations among socio-economic, environmental factors, and the development of sustainable green economies. It finds that green entrepreneurs are motivated by environmental, social, and economic objectives. Moreover, it identifies obstacles to green entrepreneurship, including limited knowledge of green technology, high initial investment costs, lack of funding, and difficulties in market entry due to associated expenses.

Bhandari (2018) analysed the concept of green entrepreneurship is at an infant stage right now but is moving towards the maturity phase. Entrepreneurs today are more cautious and moving towards more socially responsible citizens and have understood their role in sustainable business for a better tomorrow. Environmental sustainability and entrepreneurship focus on the production of green goods.

Jon Purves (2023) highlighted an insight into what makes a successful green entrepreneurship ecosystem and also stated that India’s growing economy has created a massive market opportunity for green entrepreneurs. A staggering US $3.46 trillion is the market potential for savvy and growth-oriented small entrepreneurs that want to venture into the green economy.

Nayak and Sahoo (2021) the study analysed the persistent and worsening depletion of natural reserves, escalating global temperatures, heightened

emissions of greenhouse gases, environmental pollution, and the rapid endangerment of biodiversity have prompted policymakers and institutions, both internationally and nationally, to implement regulations. These laws aim to penalize businesses contributing substantially to environmental degradation while offering incentives to firms actively engaged in green innovation.

Research Methodology

The primary objective of this study is to assess the awareness, interest, and perception of green entrepreneurship among students at GD Goenka University.A structured questionnaire was designed to gather data on various aspects related to green entrepreneurship, including awareness of available resources, interest in pursuing green ventures, confidence in developing sustainable business ideas, and perceptions regarding the significance of green entrepreneurship in addressing environmental challenges.A convenience sampling technique was employed to select participants from the student body of GD Goenka University.The survey was distributed electronically to students via email and online platforms, allowing for convenient participation and anonymity.

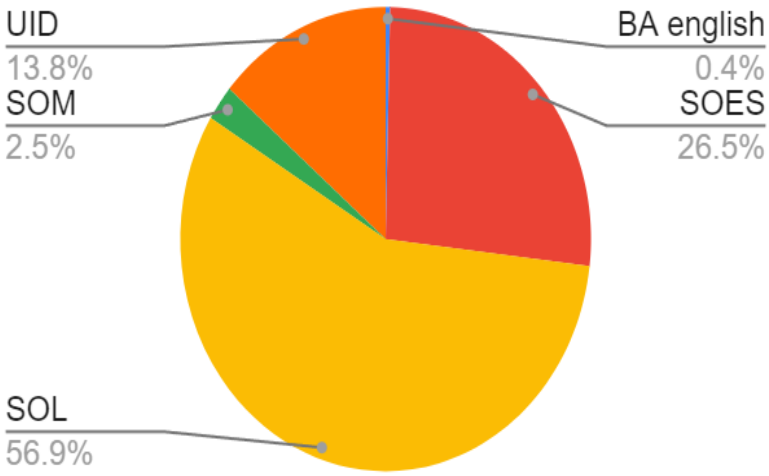


Figure: Sample response of 284 respondents

For the empirical research conducted at GD Goenka University schools, we carefully selected our sample population to ensure representation from various stakeholders involved in green entrepreneurship and sustainability practices. Our sample included students and faculty members from SOES (School of Engineering), SOM (School of Management), UID (United World Institute of Design), and SOL (School of Law). We chose these schools because they represent diverse academic disciplines and perspectives, contributing to a

comprehensive understanding of green initiatives across different fields. After distributing the questionnaires and collecting responses, we received 284 direct responses. This approach ensured the reliability and validity of our research findings, allowing us to draw meaningful insights into the landscape of green entrepreneurship within GD Goenka University schools.

Analysis and Results

The analysis of the collected data provides valuable insights into the awareness, interest, and perceptions of green entrepreneurship among third-year undergraduates at the GD Goenka University. The results are summarised as follows:

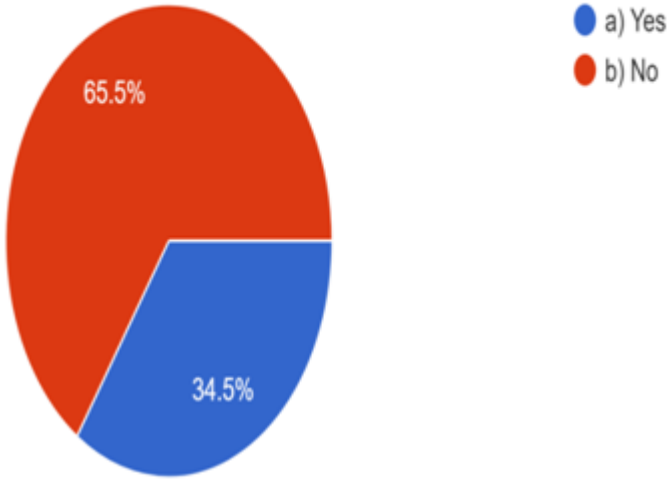


Figure: Sustainability and entrepreneurship related activities

Table 1: Survey Response- Sustainability and entrepreneurship related activities

Name of School	Uid	Soes	Sol	Som
Total No. of Students	39	77	161	7
Yes	5	25	67	2
No	34	52	94	5

The survey results indicate that the majority, accounting for 65.5% of respondents, are not involved in extracurricular activities or organisations related to sustainability or entrepreneurship. Conversely, 34.5% of respondents reported being engaged in such activities. This distribution suggests a notable

portion of individuals have some level of involvement in initiatives related to sustainability or entrepreneurship, albeit not a majority.

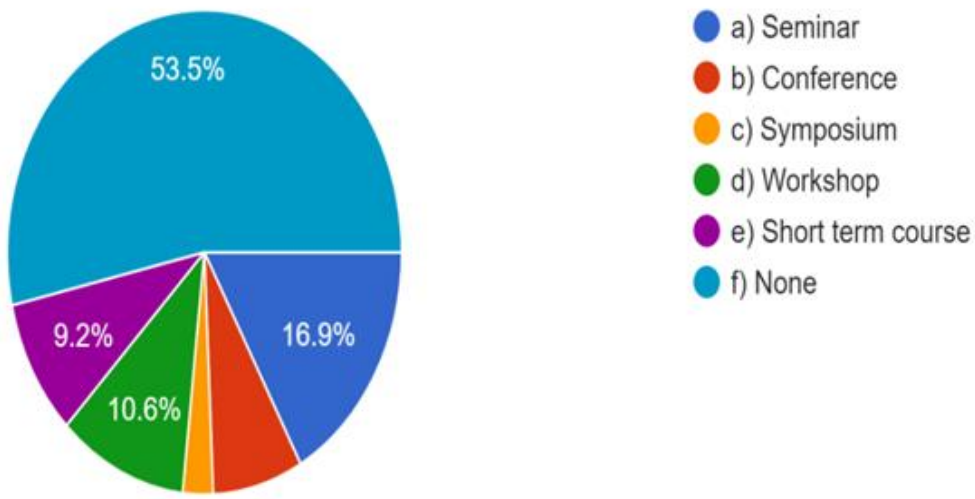


Figure: Entrepreneurship events at University level

Table 2: Survey response: Entrepreneurship events at University level

NAME OF SCHOOL	UID	SOES	SOL	SOM
TOTAL NO. OF STUDENTS	39	77	161	7
SEMINAR	6	12	30	0
CONFERENCE	1	12	8	0
SYMPOSIUM	0	4	1	2
WORKSHOP	6	3	20	1
SHORT TERM COURSE	1	12	12	2
NONE	25	34	90	3

The survey findings reveal that a significant majority, comprising 53.5% of respondents, did not attend any green entrepreneurship-related events in the recent past. Among those who did participate, workshops were the most

commonly attended, accounting for 10.6% of responses, followed by seminars at 16.9%, short-term courses at 9.2%, conferences at 7.4%, and symposiums not listed as an option. The relatively low attendance at conferences and symposiums suggests a potential gap in engagement with broader discussions or networking opportunities within the green entrepreneurship community. However, the attendance at workshops and seminars indicates a notable interest in more hands-on or focused learning experiences.

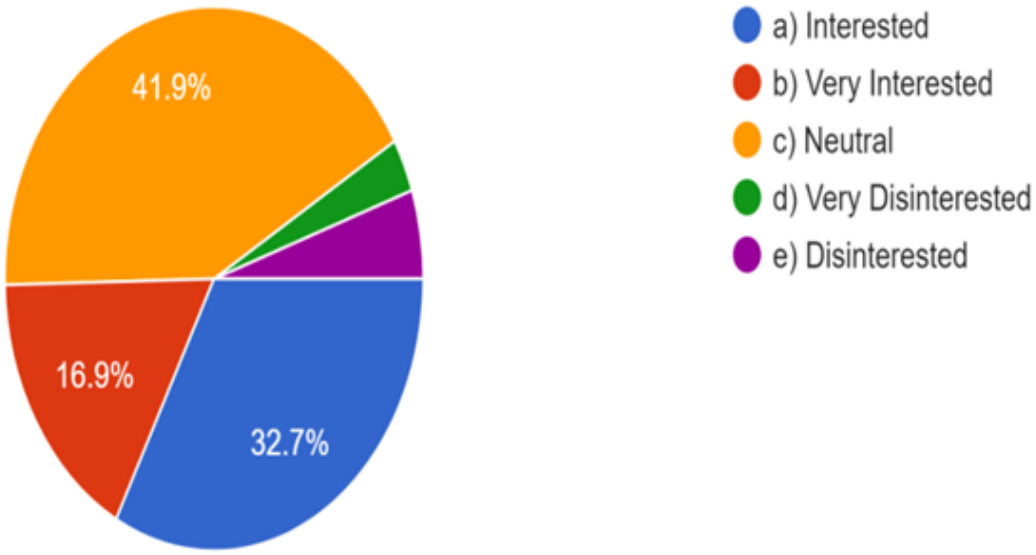


Figure: Exploring green entrepreneurship as career after graduation

Table 3: Survey response- Exploring green entrepreneurship as career after graduation

NAME OF SCHOOL	UID	SOES	SOL	SOM
TOTAL NO. OF STUDENTS	39	77	161	7
INTERESTED	17	14	58	4
VERY INTERESTED	5	15	23	1
NEUTRAL	14	33	70	0
VERY DISINTERESTED	1	4	2	2
DISINTERESTED	2	5	8	0

The survey responses indicate a mixed level of interest among respondents regarding exploring and/or pursuing green entrepreneurship as a career. A significant portion, representing 41.9% of respondents, expressed neutrality towards this career path. However, there is also considerable interest, with 16.9% indicating they are very interested and 32.7% stating they are interested. Relatively fewer respondents, 8.5%, showed disinterest or very disinterest in green entrepreneurship. This suggests a substantial segment of the surveyed population is open to or actively considering green entrepreneurship as a potential career avenue. Understanding the factors influencing individuals' levels of interest, such as awareness, perceived opportunities, or personal values, could be crucial for developing strategies to encourage and support the growth of green entrepreneurship initiatives.

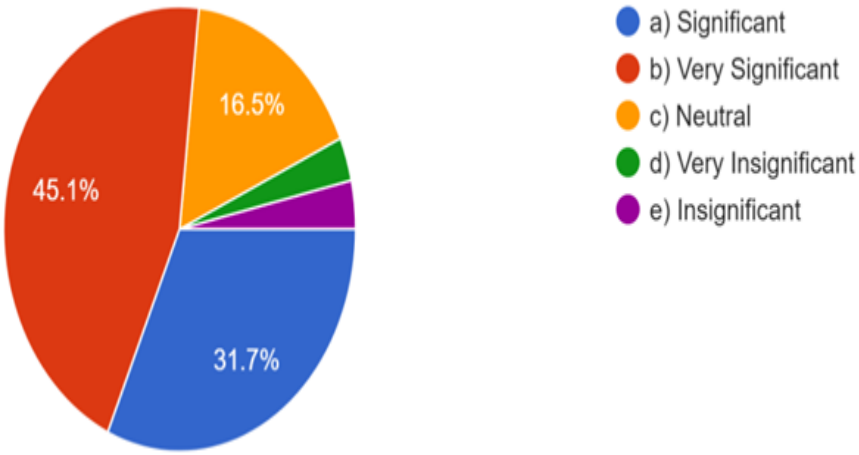


Figure: Recognition of the importance of green entrepreneurship Addressing environmental challenges

Table 4: Survey response towards the importance of green entrepreneurship addressing environmental challenges

Name of School	UID	SOES	SOL	SOM
Total No. of Students	39	77	161	7
Significant	16	18	54	2
Very Significant	14	34	76	3
Neutral	9	13	25	0
Very Insignificant	0	8	1	0
Insignificant	0	3	5	2

The survey results reflect a widespread recognition of the importance of green entrepreneurship in addressing environmental challenges. A notable majority of respondents, comprising 76.8%, expressed either significant (31.7%) or very significant (45.1%) views regarding the role of green entrepreneurship in tackling environmental issues. Conversely, a smaller portion, 16.5%, remained neutral on the matter, suggesting there is still some ambiguity or varying perspectives among respondents. The overwhelming acknowledgment of the significance of green entrepreneurship underscores its perceived potential as a viable approach for fostering environmental sustainability through innovative business practices. Understanding the reasons behind respondents' perspectives, as well as identifying any barriers to fully leveraging green entrepreneurship for environmental benefit, could inform strategies for promoting its adoption and impact.

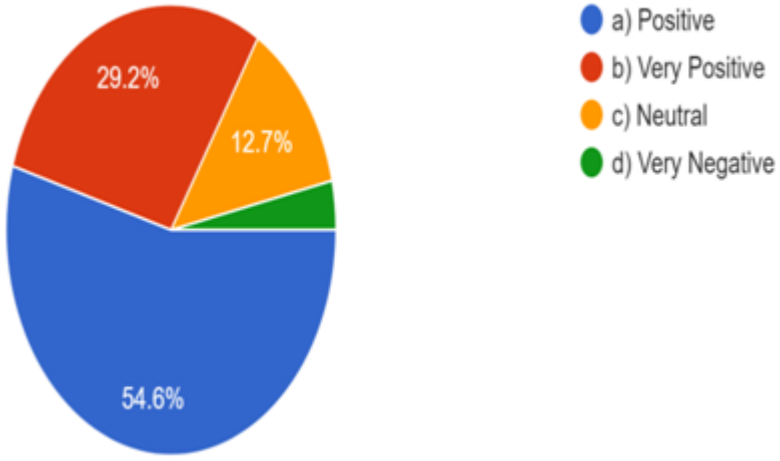


Figure: Recognition of the importance of green entrepreneurship in addressing environmental challenges

Table 5: Survey response-Recognition of the importance of green entrepreneurship in addressing environmental challenges

Name of School	UID	SOES	SOL	SOM
Total No. of Students	39	77	161	7
Positive	26	29	98	2
Very Positive	8	26	45	3
Neutral	5	15	14	1
Very Negative	0	5	4	1

The survey responses highlight a strong belief in the potential of green entrepreneurship to have a positive impact on both the environment and the economy. A significant majority, comprising 83.8% of respondents, expressed either positive (54.6%) or very positive (29.2%) views regarding the impact of green entrepreneurship. Conversely, a smaller portion, 12.7%, maintained a neutral stance on the matter. This overwhelming endorsement of the positive potential underscores the perceived dual benefits of green entrepreneurship, not only in mitigating environmental degradation but also in driving economic growth and sustainability. Understanding the factors driving respondents' optimism and identifying opportunities to further amplify the positive impacts of green entrepreneurship could inform policies and initiatives aimed at fostering its growth and maximising its contributions to both environmental and economic well-being.

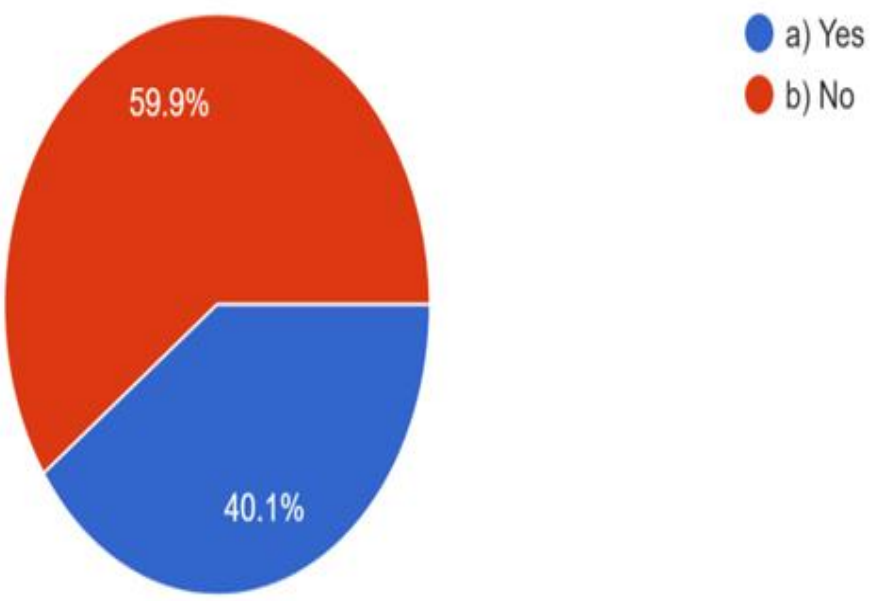


Figure: Available support systems at campus for green entrepreneurship skills and development

Table 6: Survey response- Available support systems at Campus for green entrepreneurship skills & development

Name of School	UID	SOES	SOL	SOM
Total No. of Students	39	77	161	7
Yes	7	21	83	2
No	32	57	78	5

The survey results indicate that a considerable portion of respondents, accounting for 59.9%, are not aware of any support or resources available at their college for students interested in green entrepreneurship. However, 40.1% of respondents reported being aware of such support or resources. This discrepancy suggests a potential gap in communication or accessibility of information regarding available support systems for students interested in green entrepreneurship.

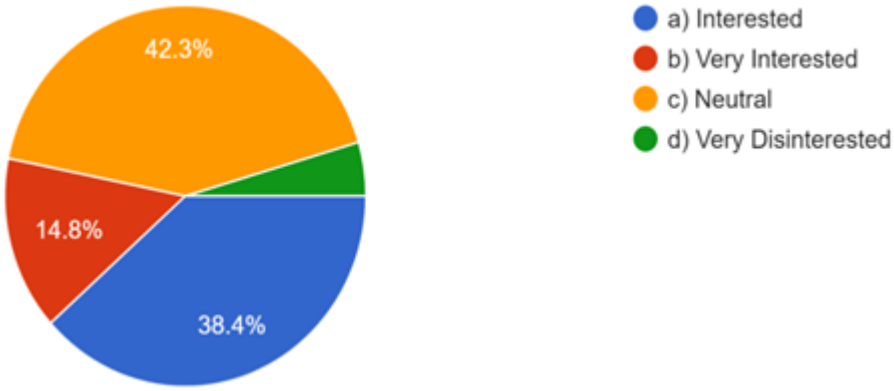


Figure: Level of interest among respondents for entrepreneurship Courses and workshops

Table 7: Survey Response- Level of interest among respondents for entreprenurship courses and workshops

Name of School	UID	SOES	SOL	SOM
Total No. of Students	39	77	161	7
Interested	15	25	67	1
Very Interested	5	13	22	1
Neutral	17	31	66	5
Very Disinterested	2	5	6	0

The survey findings reveal a notable level of interest among respondents regarding courses or workshops specifically focused on green business practices. While a significant portion, comprising 42.3% of respondents, expressed neutrality on the matter, indicating a degree of uncertainty or indifference, there is also considerable interest. Approximately 53.2% of respondents expressed some level of interest, with 38.4% stating they are

interested and 14.8% indicating they are very interested in taking such courses or workshops. This suggests a latent demand for educational opportunities tailored to green business practices among a substantial segment of the surveyed population.

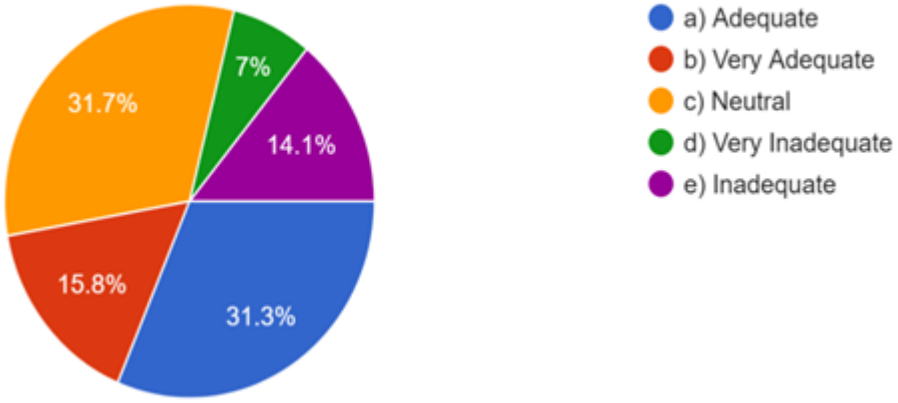


Figure: Perception for education and training opportunities

Table 8: Survey Response- Perception for education and training opportunities

NAME OF SCHOOL	UID	SOES	SOL	SOM
TOTAL NO. OF STUDENTS	39	77	161	7
ADEQUATE	4	16	67	1
VERY ADEQUATE	4	10	30	0
NEUTRAL	9	26	53	1
VERY INADEQUATE	3	11	2	3
INADEQUATE	19	9	9	2

The survey results suggest a mixed perception among respondents regarding the education and training opportunities provided by their college in the field of green entrepreneurship. While a notable portion, comprising 31.3% of respondents, viewed the opportunities as adequate and an additional 15.8% considered them very adequate, a substantial segment expressed more critical views. Approximately 21.1% of respondents indicated that the education and training opportunities were either inadequate (14.1%) or very inadequate (7%). Moreover, a significant portion, representing 31.7% of respondents, remained neutral on the matter, suggesting uncertainty or varying perspectives regarding

the sufficiency of the opportunities provided. This variation in perception highlights the importance of assessing and addressing the specific needs and preferences of students in order to enhance the quality and accessibility of education and training in green entrepreneurship within colleges.

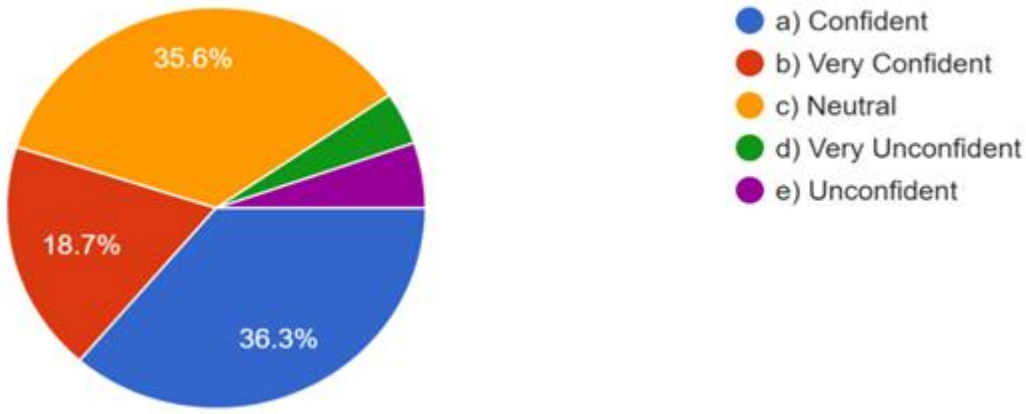


Figure: Levels of confidence and ability for development and implementation of sustainable business ideas

Table 9: Survey Response -Levels of confidence and ability for development and implementation of sustainable business ideas

Name of School	UID	SOES	SOL	SOM
Total No. of Students	39	77	161	7
Confident	18	15	67	2
Very Confident	2	20	30	0
Neutral	16	28	54	2
Very Unconfident	0	9	1	2
Unconfident	3	2	9	1

The survey results reveal a mixed level of confidence among respondents regarding their ability to develop and implement a sustainable business idea. While a significant portion, comprising 54.3% of respondents, expressed confidence (35.6%) or very confidence (18.7%) in their ability, there is also a notable percentage, 36.3%, who remained neutral on the matter. This suggests a degree of uncertainty or ambivalence regarding their own capabilities in this area. Conversely, only a small portion, 9.4%, indicated feeling either very

unconfident (4.7%) or unconfident (4.7%) in their ability to develop and implement sustainable business ideas. Understanding the factors contributing to respondents' levels of confidence, as well as addressing any perceived barriers or challenges they may face, could be essential for fostering greater empowerment and efficacy among individuals interested in pursuing sustainable entrepreneurship endeavours.

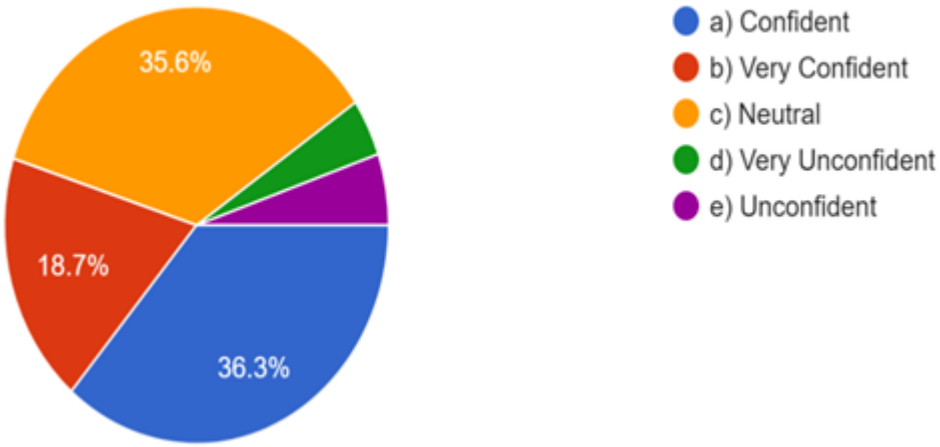


Figure: Respondents curiosity for resource and service facilities at university for green entrepreneurship startups

Table 10: Survey Response - Respondents curiosity for resource and service facilities at university for green entrepreneurship startups

Name Of School	UID	SOES	SOL	SOM
Total No. of Students	39	77	161	7
Curious	24	23	75	2
Very Curious	5	19	28	1
Neutral	10	19	54	2
Very Incurious	0	12	1	2
Incurious	0	5	3	0

The survey results indicate a considerable level of curiosity among respondents regarding green entrepreneurship-specific resources or support services available at or offered by their college. Approximately 62% of respondents expressed some degree of curiosity, with 43.7% stating they are

curious and an additional 18.3% indicating they are very curious. However, there is also a notable portion, comprising 30.3% of respondents, who remained neutral on the matter, suggesting a lack of strong interest or indifference toward exploring such resources. This variation in curiosity levels underscores the importance of effectively communicating the availability and benefits of green entrepreneurship-specific support services to engage and mobilise students. Increasing awareness and visibility of these resources could help bridge the gap between curiosity and action, empowering students to explore and leverage opportunities for sustainable entrepreneurship within their college environment.

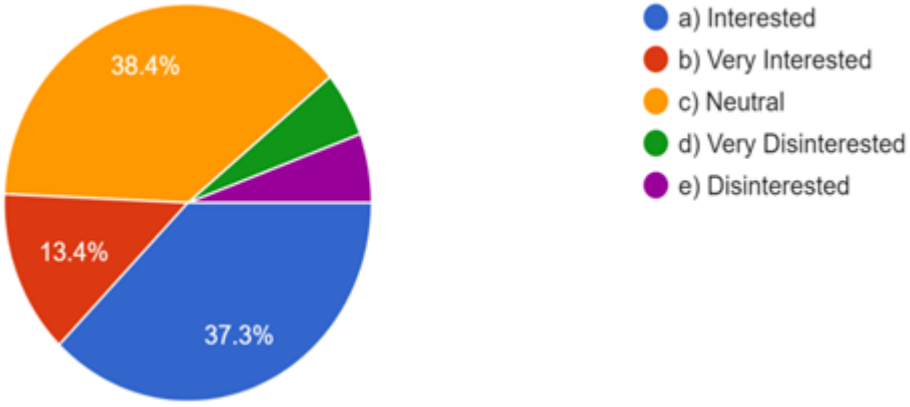


Figure: Levels of interest among respondents for green ventures after completing graduations

Table 11: Survey Response: Levels of interest among respondents for green ventures after completing graduations

Name of School	UID	SOES	SOL	SOM
Total No. of Students	39	77	161	7
Interested	17	23	65	1
Very Interested	1	13	24	0
Neutral	21	23	61	3
Very Disinterested	0	9	3	3
Disinterested	0	8	8	0

The survey results reflect a notable degree of interest among respondents in starting their own green venture after completing their studies. While a significant portion, comprising 38.4% of respondents, expressed neutrality on the matter, indicating a degree of uncertainty or indecision, there is also

considerable interest. Approximately 50.7% of respondents expressed some level of interest, with 37.3% stating they are interested and an additional 13.4% indicating they are very interested in starting their own green venture. Conversely, only a small percentage, 10.9%, expressed disinterest or very disinterest in pursuing such entrepreneurial endeavours. This suggests a substantial latent potential among students for engaging in green entrepreneurship post-graduation. Understanding the factors influencing respondents' levels of interest and addressing any perceived barriers or concerns they may have could be essential for fostering an environment conducive to the growth and success of green ventures among aspiring entrepreneurs.

Discussion

The discussion focuses on synthesising the insights gleaned from the literature review and the survey conducted among students of GDGU University regarding the state of green entrepreneurship education and initiatives. The overarching aim is to identify opportunities and challenges in fostering a supportive environment for green entrepreneurship at the university. Scholars like Yash Kumar and Veena (2021) and Renu (2021) emphasise the integration of green concepts into business models and the burgeoning interest in eco-friendly ventures. This sentiment is echoed among respondents of the GDGU University survey, who widely acknowledge the importance and positive potential of green entrepreneurship in tackling environmental issues and driving economic growth. Despite the enthusiasm surrounding green entrepreneurship, both the literature review and the survey underscore various challenges and barriers. Parminder Kaur and Surinder Kaur (2023) highlights limited knowledge and high investment costs as significant obstacles, while CS Roshini Sharma (2020) emphasises the need for coordinated support and promotion to overcome barriers to entry. Similarly, the survey among GDGU University students reveals gaps in awareness regarding available support and resources, suggesting a need for improved communication and accessibility. The survey findings shed light on the current landscape of student engagement and participation in green entrepreneurship initiatives at GDGU University. While a significant majority of respondents are not actively involved in extracurricular activities or organisations related to sustainability or entrepreneurship, there is a notable proportion exhibiting some level of engagement. This suggests a mixed landscape wherein diverse factors influence participation levels. Furthermore, while workshops and seminars garner notable interest, larger-scale conferences and symposiums seem to lack engagement, indicating potential avenues for improvement in fostering broader discussions and networking opportunities within the green entrepreneurship community. Regarding career aspirations, the survey reveals varying levels of interest among respondents in exploring green entrepreneurship as a career path, with a

substantial segment expressing neutrality but also considerable intrigue. This highlights the need for proactive efforts in raising awareness about the potential career opportunities and support available for students interested in green entrepreneurship within the university.

Limitations

The absence of dedicated courses on green entrepreneurship limits students' exposure to its concepts and opportunities, hindering awareness. Limited access to real-world examples and experiences of successful green entrepreneurs contributes to a lack of understanding among students. Cultural and societal preferences for traditional business models over sustainability can discourage students from exploring green entrepreneurship. Resource constraints, including limited funding and faculty expertise, impede the university's ability to promote awareness effectively. Without institutional support, student-led initiatives in green entrepreneurship struggle to gain traction and sustain momentum. Existing curricular structures often prioritise core courses, leaving little room for topics related to sustainability and entrepreneurship. Students may face challenges in networking with professionals and organisations in the field of green entrepreneurship. These limitations collectively hinder efforts to raise awareness and interest in green entrepreneurship among GDGU University students. Overcoming these barriers requires strategic investments in educational programs, resources, and institutional support. Addressing cultural attitudes and fostering partnerships with industry and alumni networks are also essential for promoting awareness effectively.

Implications

Increasing awareness of green entrepreneurship among students at GDGU University holds numerous benefits. Firstly, it cultivates a sense of environmental responsibility by illustrating the connection between business activities and environmental impacts, prompting students to adopt sustainable practices in their personal and professional lives. Secondly, it fosters innovation and creativity, encouraging students to develop novel solutions to environmental challenges, thereby creating economic value. Thirdly, awareness expands career opportunities in green industries such as renewable energy and waste management, equipping students with the knowledge and skills needed for success. Moreover, it promotes collaboration and networking among students, faculty, industry professionals, and environmental organisations, driving collective action towards sustainability. Additionally, it stimulates economic growth by fostering innovation and creating new markets, contributing to the transition towards a more sustainable economy. Finally,

promoting awareness enhances GDGU University's reputation as a leader in sustainability education and research, attracting individuals and partners who share its commitment to environmental stewardship and social responsibility.

Conclusion

In conclusion, the survey conducted among GD Goenka University students offers valuable insights into the landscape of green entrepreneurship engagement, perceptions, and aspirations within the student community. While a significant majority may not currently be actively involved in related activities, the presence of a notable proportion expressing engagement underscores the potential for fostering increased participation. Addressing gaps in awareness of available resources and support services is crucial to nurturing a supportive environment conducive to the growth of green entrepreneurship initiatives. Moving forward, tailored strategies aimed at enhancing engagement, communication, and accessibility are essential for empowering aspiring green entrepreneurs and leveraging the positive potential of green entrepreneurship in addressing environmental challenges and fostering economic growth within the university community.

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Navigating the Metaverse: A Balancing Act of Intellectual Property, Privacy & Education

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Abstract

The Metaverse, a virtual world brimming with potential, raises critical questions regarding intellectual property (IP), privacy and education. This work delves into these interconnected facets, exploring the challenges and opportunities they present within this immersive landscape. The Metaverse fosters creativity and innovation. However, the lack of established IP frameworks poses a threat to creators. The research will explore potential solutions, such as the implementation of blockchain technology to ensure clear ownership and facilitate fair compensation. The research will also discuss the need for robust regulations that protect user data and prevent unauthorized collection or exploitation. It will also examine the potential for anonymity and pseudonymity within the Metaverse, considering their implications for both safety and accountability. Education plays a crucial role in navigating this uncharted territory. It will further highlight the need for educational initiatives that equip users with the knowledge and skills necessary to thrive in the taverse.

This includes understanding IP rights, protecting privacy, and engaging responsibly within the virtual environment.

Keywords: metaverse, IP, privacy, creativity, innovation

Introduction

The Metaverse, a captivating realm where the physical and digital converge, is rapidly emerging. Within this virtual expanse, boundless opportunities await immersive experiences, unparalleled creativity, and the potential for a radically redefined social landscape. However, alongside this exhilarating potential lies a complex web of challenges. This journey delves into the intricate dance between intellectual property (IP), privacy, and education within the Metaverse. We'll explore how these fundamental principles intertwine, shaping the very fabric of this evolving virtual world. Imagine building a virtual masterpiece – a breath-taking sculpture or a captivating story – only to have it replicated and distributed without your consent. The Metaverse, with its emphasis on user-generated content, throws IP protections into question. We'll examine the existing legal frameworks and

explore innovative solutions, like blockchain technology, to ensure creators are fairly compensated for their work.

As we step into the Metaverse, a vast amount of data trails behind us. Our preferences, movements, and interactions are all potential targets for collection and exploitation. We'll discuss the crucial need for robust privacy regulations to safeguard this sensitive user information. Additionally, we'll delve into the potential for anonymity and pseudonymity, considering their impact on safety, accountability, and the overall user experience. The Metaverse presents a vast new territory for both creators and consumers. Equipping users with the necessary knowledge and skills becomes paramount. This includes understanding IP rights, navigating privacy settings, and engaging responsibly within this immersive environment. We'll explore how comprehensive educational initiatives can empower users to become responsible citizens of the Metaverse.

By carefully considering and addressing these critical aspects of IP, privacy, and education, we can ensure the Metaverse flourishes as a platform for creativity, connection, and progress. Through ongoing collaboration between creators, users, policymakers, and educators, we can shape a responsible and inclusive metaverse for all. This introduction sets the stage for our further exploration of these interconnected issues. As we delve deeper, we'll equip you with the knowledge needed to navigate the Metaverse with confidence.

Literature Review

The concept of the metaverse, a persistent, interconnected network of 3D virtual worlds, has captured the imagination of scholars, technologists, and corporations alike. However, this incipient virtual frontier presents a unique set of challenges, particularly regarding intellectual property (IP), privacy, and education. This review examines these key areas, drawing on existing literature and highlighting real-world examples from companies actively shaping the Metaverse landscape.

Blankinship and **Consalvo** (2020) highlight the potential for rampant plagiarism and infringement within the Metaverse, where digital assets can be easily replicated and distributed. They advocate for the development of clear ownership guidelines and enforcement mechanisms specific to the virtual environment. A recent lawsuit between Nike and Roblox in 2023 regarding the sale of virtual Nike sneakers in the Metaverse highlights the ongoing challenges of enforcing copyright and trademark in this new landscape. Further research is

needed to explore how courts will handle these issues and how platforms can implement effective takedown mechanisms (**Blankinship & Consalvo, 2020**).
Others, like **Choi et al. (2021)**, propose leveraging blockchain technology to address these concerns. Blockchain's inherent features, such as immutability and transparency, can be utilized to create a secure and verifiable record of ownership for digital assets. This can empower creators to maintain control over their work and ensure they receive fair compensation for its use. Decentralized Autonomous Organizations (DAOs) are emerging as a potential structure for Metaverse communities. A 2023 research paper by Ahn et al. explores the potential benefits and risks of DAOs in managing virtual spaces, emphasizing the need for clear legal frameworks.

On the other hand, some scholars like **Goldsmith and Stratton (2022)**, express reservations about the potential for over-regulation within the Metaverse. They argue that overly restrictive IP laws could stifle creativity and hinder innovation within this nascent virtual space. They advocate for a balanced approach that protects creators' rights while fostering a vibrant and dynamic ecosystem.

Roblox Corporation has established a robust copyright system, allowing creators to monetize their work through virtual currency earned from in-game sales (**Roblox Corporation, n.d.)**. **Meta (formerly Facebook)** is exploring the use of blockchain technology for Metaverse applications, including potential solutions for digital asset ownership (**Meta Platforms Inc., 2022**).
As users engage with the Metaverse, they generate a vast amount of data – their preferences, movements, interactions, and even biometric information. This data presents a significant privacy concern, with the potential for misuse by corporations, malicious actors, or even governments. Meta (formerly Facebook) has been under scrutiny for its data collection practices within the Metaverse platform Horizon Worlds. A 2022 investigation by the Wall Street Journal revealed concerns about user privacy and the potential for misuse of biometric data. Several studies have explored the privacy implications of the Metaverse. **Solove (2004)** emphasizes the importance of user control over their personal data. He argues that users should have the right to access, correct, and delete any information collected about them within the Metaverse.

Deirdre Mulligan (2012) delves into the concept of "filter bubbles" and "echo chambers" that could potentially emerge within the Metaverse. These algorithmic filters could limit users' exposure to diverse viewpoints, potentially creating a fragmented and polarized virtual society. A 2022 study by the Pew Research Center found that a growing number of internet users (72%) are concerned about the spread of misinformation online. This concern extends to the Metaverse, where algorithmic bias could limit exposure to diverse

viewpoints and exacerbate societal polarization (Mulligan, 2012). To address these concerns, scholars like Wright (2017) propose the implementation of robust privacy regulations within the Metaverse. These regulations would need to be adaptable to the evolving nature of virtual technology while ensuring user data remains secure and protected from unauthorized access or exploitation.

Meta launched its **Education division in 2023**, focusing on developing VR and AR learning tools for the Metaverse. One example is their collaboration with Arizona State University (ASU) to pilot a VR language learning program. Several researchers have explored the educational potential of the Metaverse. **Picton (2013)** discusses the use of virtual reality (VR) technologies to create immersive learning environments that can enhance student engagement and knowledge retention. The World Economic Forum released a report in 2023 highlighting the importance of bridging the digital divide to ensure equitable access to the Metaverse. Initiatives like the "Meta Connectivity Lab" are working on developing affordable VR/AR technologies to bridge this gap.

Liu et al. (2020) delve into the potential of the Metaverse for personalized learning experiences. By tailoring educational content to individual student needs and preferences, the Metaverse can create a more effective and engaging learning environment. However, challenges remain. **Moss and Williamson (2020)** highlight the potential for a digital divide within the Metaverse, where access to necessary technology could exacerbate existing educational inequalities. Furthermore, the ethical implications of using immersive technologies for education require careful consideration. To address these challenges, scholars like **Thomas and Grimes (2018)** advocate for the development of comprehensive educational programs that equip users with the knowledge and skills necessary to navigate the Metaverse responsibly. This includes understanding IP rights, protecting their privacy, and engaging ethically within the virtual environment. Meta is investing in VR education initiatives, partnering with organizations like Arizona State University to develop VR classrooms (**Meta Platforms Inc., 2022**). Striver offers VR training simulations used by companies like Walmart and Pepsico to train employees (**Strivr, n.d.**).

Research Gap

The Metaverse presents a novel and complex environment where existing legal and social frameworks struggle to keep pace with technological advancements. This creates significant research gaps in navigating the interplay between intellectual property (IP), privacy, and education within this virtual realm. Here's a breakdown of some key areas demanding further exploration:

Standardization of Ownership Mechanisms: Existing IP laws struggle to define ownership of user-generated content and virtual assets within the Metaverse. Research is needed to develop standardized mechanisms for establishing clear ownership, attribution, and licensing models.

- **AI-Generated Content and Ownership:** As Artificial Intelligence (AI) plays a more prominent role in content creation within the Metaverse, research is needed to determine ownership rights for AI-generated works. Who owns the IP – the creator of the AI or the user who utilizes it to generate content?

- **Fine-Grained Privacy Controls:** Current privacy frameworks struggle to address the granularity of data collection within the Metaverse. Research is needed to develop user-centric privacy controls that allow users to manage the collection, use, and sharing of their data within the virtual environment.

- **Data Ownership and Control in Educational Metaverse Platforms:** With the vast amount of student data collected within educational Metaverse platforms, research is needed to determine how students and educators can maintain control and ownership over their personal information. This includes exploring opt-in/opt-out mechanisms and data portability options

- **Balancing Personalized Learning with Privacy:** The Metaverse offers potential for highly personalized learning experiences. However, this personalization often relies on extensive user data collection. Research is needed to explore ways to achieve effective personalization while protecting student privacy and mitigating potential biases in algorithmic filtering.

- **Developing Effective Pedagogical Approaches:** While the Metaverse offers exciting potential for education, research is needed to develop effective pedagogical approaches that leverage the unique affordances of virtual environments to enhance learning outcomes.

- **The Role of Educators and Educational Institutions:** Educators will need to be equipped with the necessary skills and knowledge to guide students within the Metaverse. Research is needed to explore the role of educational institutions in preparing future generations for responsible and ethical engagement in the virtual world.

- **Ownership of Educational Materials:** The Metaverse presents new opportunities for the collaborative creation of educational resources. Research is needed to explore how ownership and licensing of these co-created materials will be managed within educational settings.

By addressing these research gaps, we can ensure the Metaverse flourishes as a platform for creativity, connection, and progress. Through ongoing research and collaboration, we can shape a responsible and inclusive Metaverse for all.

Objectives

The metaverse presents a fascinating opportunity, but one intertwined with complex challenges. To ensure its responsible and inclusive development, we need to establish clear objectives regarding intellectual property (IP), privacy, and education. Here's a breakdown of these key objectives:

- Develop Standardized Ownership Mechanisms: Establish clear and standardized frameworks for determining ownership of user-generated content and virtual assets within the Metaverse. This includes defining attribution rights and creating licensing models that ensure fair compensation for creators.

- Adapt IP Laws for the Metaverse: Investigate and adapt existing IP laws to address the unique realities of the Metaverse. This may involve creating new categories of IP protection specifically tailored to virtual assets and experiences.

- Foster Innovation and Creativity: Ensure IP frameworks encourage innovation and creativity within the Metaverse. This might involve exploring alternative copyright terms or leveraging blockchain technology for efficient rights management.

- Establish Robust Security Protocols: Create strong security protocols to safeguard user data from breaches and unauthorized access within the Metaverse. This includes addressing the potential vulnerabilities of decentralized platforms.

- Balance Anonymity and Accountability: Strike a balance between anonymity (protecting users from harassment) and accountability (ensuring responsible behavior within the Metaverse). Consider reputation systems or other approaches that can promote responsible engagement.

- Develop Effective Learning Strategies: Explore and develop effective pedagogical approaches that leverage the unique affordances of the Metaverse to enhance learning outcomes. This may involve creating immersive simulations, interactive learning experiences, and personalized learning pathways.

- Equip Educators for the Metaverse: Provide educators with the necessary training and skills to guide students effectively within the Metaverse. This includes fostering digital literacy skills and promoting responsible and ethical engagement in the virtual environment.

Hypothesis

The dynamic nature of the Metaverse necessitates a multifaceted approach to achieving a balanced ecosystem. This hypothesis proposes that by fostering a collaborative effort involving creators, users, policymakers, and educators, we can establish a framework for navigating the Metaverse that optimizes intellectual property (IP) protection, user privacy, and educational opportunities. It further lays the groundwork for a responsible and inclusive Metaverse. By fostering collaboration, developing adaptive frameworks, and prioritizing user education, we can create a thriving virtual space that fosters creativity, connection, and progress for all.

Research Methodology

The multifaceted nature of the Metaverse demands a comprehensive research methodology that incorporates various approaches to capture a holistic understanding of this evolving virtual landscape. This research will explore how to navigate the Metaverse while balancing intellectual property (IP), privacy, and education. A thorough examination of existing academic literature, industry reports, and white papers has provided a foundational understanding of current research and discussions regarding IP, privacy, and education within the Metaverse. Scholarly databases, industry publications, and relevant websites have been explored to identify relevant sources. In-depth analysis of specific Metaverse platforms or applications has provided a real-world examples of how IP, privacy, and educational considerations are being addressed. This can reveal best practices and highlight areas for improvement.

Findings

As the research on navigating the metaverse unfolded, several key findings emerged regarding the interplay between intellectual property (IP), privacy, and education within this virtual environment:

- **Uncertain Ownership Landscape:** The research highlighted the current lack of standardized frameworks for establishing ownership of user-generated content and virtual assets within the Metaverse. This ambiguity creates uncertainty for creators and hinders content creation.

- **Demand for Clear IP Frameworks:** Stakeholders, particularly creators, expressed a strong desire for clear and adaptable IP frameworks that protect their rights and ensure fair compensation within the Metaverse.

- Potential of Blockchain Technology: The research identified the potential of blockchain technology to address ownership concerns. Blockchain's secure and transparent record-keeping could facilitate efficient rights management for virtual assets.

- **Need for Robust Security Protocols:** The research emphasized the critical need for robust security protocols to safeguard user data from breaches and unauthorized access within the Metaverse. This is particularly important for decentralized platforms.

- **Need for Effective Pedagogical Approaches:** The research identified the need for developing effective pedagogical approaches that leverage the unique affordances of virtual environments to enhance learning outcomes within the Metaverse.

- **Importance of Educating Educators:** The research underscored the importance of equipping educators with the necessary skills and knowledge to guide students effectively within the Metaverse and promote responsible engagement.

These findings offer valuable insights for shaping a future Metaverse that fosters creativity, protects user rights, and empowers individuals to navigate this virtual space responsibly.

Conclusion

The research on navigating the Metaverse, balancing intellectual property (IP), privacy, and education, paints a compelling picture of the challenges and opportunities that lie ahead in this Bourgoing virtual space. Here's a breakdown of the key conclusions that emerge from the research findings:

- **Urgent Need for Collaboration:** The research underscores the urgent need for collaboration between stakeholders – creators, users, policymakers, and educators – to establish a robust framework for the Metaverse. This collaboration is crucial for developing clear IP frameworks, ensuring user privacy, and promoting responsible engagement through education. Failure to collaborate could lead to a fragmented and potentially exploitative virtual environment.

- **Balancing Rights and Innovation:** Striking a balance between protecting creators' IP rights and fostering innovation within the Metaverse is critical. Overly restrictive IP frameworks could stifle creativity, while a lack of protection could discourage content creation. The research suggests exploring solutions like blockchain technology and adaptable copyright terms to achieve this balance.

- **Empowering Users through Privacy:** User trust is paramount for the Metaverse's success. The research emphasizes the need for user-centric privacy controls that empower individuals to manage their data. This includes offering granular control over data collection, usage, and sharing. Additionally, robust security protocols are essential to safeguard user data from breaches and unauthorized access.

- **Education:** The Cornerstone of Responsible Engagement: The research identifies education as the cornerstone of responsible Metaverse engagement. Educational initiatives are crucial for equipping users with the necessary skills to navigate the Metaverse – understanding IP rights, protecting their privacy, and engaging ethically. Additionally, educators themselves need to be trained to guide students effectively within this new virtual environment.

Limitations

The research on navigating the Metaverse, while offering valuable insights, has some limitations that need to be considered:

- **Evolving Landscape:** The Metaverse is a rapidly evolving environment. New technologies and user behaviors could emerge, potentially rendering some of the research findings outdated. Further research will be necessary to keep pace with this dynamic virtual space.
- **Access Constraints:** Gaining access to certain Metaverse platforms or specific user demographics might have been limited. This could restrict the generalizability of the findings to the broader Metaverse population. Further research with more diverse participants would strengthen the study's conclusions.
- **Focus on Specific Aspects:** The research prioritized intellectual property, privacy, and education. Other crucial aspects, like the potential psychological and social impacts of the Metaverse, require separate investigations to fully understand the virtual world's implications.
- **Limited Scope of Solutions:** While the research explored potential solutions, such as blockchain technology for IP management and user-centric privacy controls, more in-depth research is needed to evaluate their feasibility and effectiveness within the complex Metaverse ecosystem.

These limitations highlight the need for ongoing research efforts to keep pace with the Metaverse's development. By acknowledging these limitations, we can ensure that future research builds upon this foundation and provides a comprehensive understanding of navigating the Metaverse responsibly.

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Ethical Considerations in Implementing Solutions for Building Sustainable Smart Cities

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Abstract

The paper identifies a number of specific ethical concerns that arise in the context of smart city implementation. These concerns include The potential for surveillance and data collection to infringe on individuals' privacy; The use of artificial intelligence (AI) to make decisions that could have a significant impact on people's lives; The potential for smart city technologies to exacerbate existing social and economic inequalities; The environmental impact of smart city infrastructure & The governance of smart cities and the need for transparency and accountability. This paper argues that ethical considerations must be at the forefront of the development and implementation of smart city solutions. Only by ensuring that smart cities are developed and implemented in an ethical way can we ensure that they benefit all of society.

Keywords: Smart Cities, Surveillance, Ethics, Sustainability.

Introduction

The concept of smart cities has gained significant traction in recent years, promising to address the challenges of urbanization and promote sustainable development. However, the implementation of smart city solutions raises a number of ethical concerns that need to be carefully considered. This research paper will explore these ethical considerations in detail, examining the potential impacts of smart city technologies on individuals, communities, and society as a whole. The term “smart city” may refer to technological additions to existing cities, or entirely new cities built with “smartness” in mind. The first example of a smart city that comes to mind might be prototypical, either from a Silicon Valley or a Utopian framing (Gibbs et al., 2013; Hollands, 2008; March, 2016). “Smart city” may refer to citywide efforts to implement new Information and Communication Technologies (ICT) or transportation systems, like in New York or Los Angeles. Alternatively, smart cities may be brand new, entirely constructed cities, like Songdo International Business District in South Korea or the New Clark City (NCC) development project in the Philippines. The expression “smart city” might also refer to the development of a particular neighbourhood, such as Quayside in Toronto or Speirs Locks in Glasgow. Analysing the host of labels and definitions revolving around the term “smart

city" has normative relevance in itself, as it can shed light on the complex dynamics at play. To understand why and how, consider the following three points. First, the terminological debate is likely to reveal the set of conflicting interests behind the term. The label "smart city" is a part of contemporary language around urban development and management that includes consultants, professionals, marketing authorities, among others, and this language frames how cities are conceived, conceptualised, and planned (Praharaj & Han, 2019). In the literature, this is expressed by the citizen-led, private-led, or city-led smart city jargon (Cohen & Cohen, 2015), as well as in the tension behind technology-driven and human-driven conceptions of smart city (Echebarria et al., 2020; Kummitha & Crutzen, 2017).

Literature Review

Cities are home to most of the world's population. They are the sites where most consumption and production occur and where most of the negative environmental externalities originate (Allam & Dhunny, 2019; Yun et al., 2016). In terms of numbers, around 55% of the global population resides in cities whose fabric is rapidly evolving (Chen et al., 2020), with this figure reaching a peak of 85% in countries like Australia, the UK, and the Netherlands (Metaxiotis et al., 2019). This is why cities rather than nations have become the unit of interest of a substantial part of social, economic and sustainability policy (Praharaj et al., 2018; Yigitcanlar & Dur, 2016). This shift has given rise to the idea of using technological innovations to address major urban and societal challenges (Trencher, 2019). As a result, the concept of "smart city" was born. Smart cities use new technologies, such as AI and big data analytics, for various applications, such as transportation, trash collection, street repairs, administrative efficiency, surveillance, and more (Kitchin, 2018; Sourbati & Behrendt, 2021). They can represent a solution to traditional cities' problems (Csukás & Szabo, 2021; Hassan & Awad, 2018; Lam & Ma, 2019; Zou, 2019). In this respect, researchers deem smart cities to have a great potential to improve efficiency compared to traditional cities. This potential rests on increased interconnectedness and interactions of city systems and networks (Nam & Pardo, 2011). Thus, "smartness" can be interpreted as a new level of efficiency through integrating public and private systems (Naphade et al., 2011). Furthermore, smart cities bring about entirely new opportunities (Yigitcanlar, Desouza, et al., 2020). For example, the technologies involved in a smart city do not just make the trains run more efficiently, they also enable city officials to collect information about the train schedule and train passengers with techniques including facial recognition scans, gait recognition, body temperature, and more. As the example shows and as we shall discuss in the following pages, this means that smart cities may also include technology and sensors that follow people into their private spaces. Both as solutions to old

problems and as new opportunities for the present, smart cities come with their own risks and challenges, which require ethical scrutiny. The very idea of a smart city is controversial. Its prevalent conceptualisation merely in terms of technology and optimisation potential (e.g., Anand, 2021; Yigitcanlar, Butler, et al., 2020) might eclipse other relevant aspects. Thus, some authors urge acknowledging the complex character of urban life, instead of conceiving the city as an element to optimise (Green, 2020; Kourtit & Nijkamp, 2012). Inevitably, the definition of a smart city plays a role in setting the stage for any ethical analysis.

Research Questions

The following research questions will guide the development of this research paper:

- What are the ethical principles that should guide the development and implementation of smart city solutions?
- What are the specific ethical concerns that arise in the context of smart city implementation?
- How have these ethical concerns played out in the real world?
- What are potential solutions to these ethical concerns?

Research Gap

While there is a growing body of literature on the ethical considerations of smart cities, there is still a need for more research on this topic. In particular, there is a need for more research on the following:

- The potential impacts of smart city technologies on specific groups of people, such as minority communities, low-income communities, and people with disabilities.
- The development of ethical frameworks for the development and implementation of smart city solutions.
- The use of case studies to examine how ethical considerations have been addressed in the implementation of smart city projects.

Objectives

The objectives of this research paper are to:

- Identify and discuss the ethical considerations in implementing solutions for building sustainable smart cities.

- Suggest potential solutions to these ethical concerns.
- Provide recommendations for ensuring that smart cities are developed and implemented in an ethical way.

Methodology

This research paper uses a qualitative research methodology. This means that the paper draws on a variety of sources, including academic literature, case studies, and expert interviews. The paper will also use a critical lens to examine the ethical considerations of smart city implementation.

Analysis and Findings

The analysis of the literature and case studies reveals a number of ethical concerns that need to be addressed in the implementation of smart city solutions. These concerns include:

- The potential for surveillance and data collection to infringe on individuals' privacy
- The use of artificial intelligence (AI) to make decisions that could have a significant impact on people's lives
- The potential for smart city technologies to exacerbate existing social and economic inequalities
- The environmental impact of smart city infrastructure
- The governance of smart cities and the need for transparency and accountability.

Expected Outcomes

The expected outcomes of this research paper are:

- A comprehensive overview of the ethical considerations in implementing solutions for building sustainable smart cities
- A critical analysis of the potential impacts of smart city technologies on individuals, communities, and society as a whole
- Recommendations for ensuring that smart cities are developed and implemented in an ethical way

Limitations

The concept of smart cities has gained significant traction in recent years, promising to address the challenges of urbanization and promote sustainable

development. However, the implementation of smart city solutions raises a number of limitations that need to be carefully considered.

- **High Implementation Costs:** Developing and implementing smart city solutions can be extremely expensive. This is because smart cities require a significant investment in infrastructure, technology, and data management. The cost of acquiring and maintaining sensors, networks, and data centers can be prohibitive for many cities, particularly those with limited resources.

- **Technological Complexity:** Smart cities rely on a complex network of interconnected technologies, including sensors, data analytics, and artificial intelligence. Integrating these technologies seamlessly can be a daunting task, and the challenges of interoperability and data integration can hinder the smooth operation of smart city systems.

- **Privacy Concerns:** The vast amount of data collected by smart city sensors raises concerns about privacy. Smart cities can track individuals' movements, monitor their activities, and collect sensitive personal information. This raises concerns about the potential for misuse of data and the erosion of individual privacy.

- **Digital Divide:** Smart city technologies often require a high level of digital literacy and access to technology. This can exacerbate existing digital divides, leaving marginalized communities further disadvantaged. Ensuring that smart city benefits are accessible to all requires addressing the digital divide and providing digital literacy training.

- **Cybersecurity Vulnerabilities:** The increased reliance on technology in smart cities also increases the risk of cyberattacks. Smart city systems are highly interconnected, and a security breach in one system could compromise the entire network. This raises concerns about the potential for disruptions to critical infrastructure and services.

- **Sustainability Concerns:** The development and operation of smart cities can have environmental impacts. The manufacturing and disposal of electronic devices, the energy consumption of data centers, and the increased demand for resources can all contribute to environmental degradation. Sustainable smart cities must consider these impacts and find ways to minimize their environmental footprint.

- **Governing Smart Cities:** The governance of smart cities presents a complex challenge. Smart cities require a new type of governance that

can effectively manage and regulate the use of data, technology, and public resources. This requires clear policies, transparent decision-making processes, and public accountability.

- **Social and Ethical Considerations:** The implementation of smart city solutions can have significant social and ethical implications. It is important to consider the potential impacts of these technologies on individuals, communities, and society as a whole. This includes issues of privacy, equity, justice, and transparency.

Managerial Implication

City planners, policymakers, and technology companies should carefully consider the ethical implications of smart city technologies before implementing them. This includes conducting thorough assessments of the potential impacts of these technologies on individuals, communities, and society as a whole. It also includes developing clear policies and procedures for the collection, use, and storage of data collected by smart city sensors.

Theoretical Implication

This research contributes to the growing body of literature on the ethical considerations of smart cities. It identifies a number of important ethical concerns that need to be addressed, and it suggests potential solutions to these concerns. The findings of this research can be used to inform the development of ethical frameworks for the development and implementation of smart city solutions.

Future Scope

As smart city technologies continue to evolve, it is important to continue to research and address the ethical implications of these technologies. In particular, there is a need for more research on the following:

- The development of ethical guidelines for the use of artificial intelligence (AI) in smart cities.
- The potential impacts of smart city technologies on specific groups of people, such as minority communities, low-income communities, and people with disabilities.
- The use of case studies to examine how ethical considerations have been addressed in the implementation of smart city projects.

Additional areas of research could include:

- The development of new technologies that can help to mitigate the ethical concerns of smart cities.
- The implementation of best practices for the development and implementation of smart city solutions.
- The development of public education programs to raise awareness of the ethical implications of smart cities.

Conclusion

This research paper will provide a valuable contribution to our understanding of the ethical considerations in implementing solutions for building sustainable smart cities. The paper will identify and discuss a number of important ethical concerns, and it will suggest potential solutions to these concerns. The paper will also provide recommendations for ensuring that smart cities are developed and implemented in an ethical way. The ethical considerations in implementing solutions for building sustainable smart cities are complex and multifaceted. However, it is essential to address these concerns in order to ensure that smart cities are developed and implemented in a way that benefits all of society. By incorporating ethical principles into the design and implementation of smart city solutions, we can create cities that are not only efficient and sustainable, but also just and equitable.

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A Cross-Sectional Study of Gender-Based Violence against Men in South Delhi

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Abstract

Men's movements have undergone a significant evolution over the years, ranging from efforts to address traditional gender roles and stereotypes to embracing pro-feminist ideologies. While the focus on women's rights and protections in legal frameworks is crucial, there exists a noticeable gap in addressing issues concerning men, particularly regarding sexual assault and harassment. This essay aims to explore the history of men's liberation and pro-feminist men's movements, examining their origins, ideologies, and impact on societal perceptions of masculinity. Furthermore, it will analyze the need for gender-neutral legislation, supported by data on male victims of sexual assault.

Keywords: men, gender, masculinity, assault

Introduction

Men's Liberation Movement: Origins and Ideals

The Men's Liberation Movement emerged in the 1960s and 1970s alongside the feminist movement, aiming to address societal expectations and constraints placed upon men. Rooted in the critique of traditional gender roles and patriarchal norms, proponents of men's liberation sought to dismantle the rigid constructs of masculinity that perpetuated harmful behaviors and attitudes. Central to their ideology was the belief that true equality could only be achieved by challenging the oppressive systems that restricted both men and women.

One of the key figures in the Men's Liberation Movement was Warren Farrell; whose book "The Myth of Male Power" challenged traditional notions of male privilege and power. Farrell argued that men, too, were victims of societal expectations, such as the pressure to conform to dominant masculine norms, which often resulted in emotional repression and dissatisfaction.

Pro-Feminist Men's Movement: Bridging the Gap

As feminism grew, some men supported women's rights, challenging sexism and misogyny, leading to the pro-feminist men's movement. This movement aimed to deconstruct toxic masculinity and promote gender equality. Groups like NOMAS and Men Can Stop Rape have been key, offering educational initiatives and advocacy to foster respect and empathy.

Legal Frameworks and Gender Neutrality: A Call for Reform

Despite progress in addressing gender-based violence, legal frameworks often neglect male victims. In India, laws like the Indian Penal Code and the Sexual Harassment of Women at Workplace Act focus on women, ignoring men's experiences. To achieve true gender equality, legal reforms must ensure gender-neutral protections for all individuals.

Data on Male Victims: Shifting the Narrative

Although sexual violence is often perceived as primarily affecting women, research shows that men are also vulnerable. A CDC study reveals that about 1 in 10 men in the U.S. have experienced rape, sexual assault, or stalking by an intimate partner. However, male victims face significant barriers to seeking support and justice due to underreporting and societal stigma. Those who do come forward often encounter disbelief or ridicule, worsening their trauma. Recognizing the prevalence of sexual violence against men and challenging stereotypes can foster a more inclusive and supportive environment for all survivors.

Literature Review

Primary Sources

The edited volume "Sexual Violence Against Men in Global Politics," compiled by Marysia Zalewski, Paula Drumond, Elisabeth Prugl, and Maria Stern, delves into the complex intersections of gender, power, and violence in global politics. By focusing on sexual violence against men, the book challenges conventional narratives that often overlook male victims and underscores the importance of addressing their experiences within broader discussions on gender-based violence.

The Indian Penal Code (IPC) of 1860 serves as a foundational legal document in India, outlining various criminal offenses, including those related to sexual violence. However, as highlighted by Menon (2013) in "Seeing like a

Feminist," the IPC primarily focuses on protecting the sexual honor of women, neglecting the experiences of male victims. Menon's work provides valuable insights into the gender biases inherent in legal frameworks and underscores the need for gender-neutral legislation to address sexual violence comprehensively.

Secondary Sources

Secondary sources complement primary literature by offering additional perspectives and analyses on sexual offenses, gender dynamics, and related psychological phenomena.

The essay "Sexual Offences in India Law" provides a comprehensive overview of legal provisions pertaining to sexual offenses in India, offering insights into the historical context, legislative frameworks, and challenges in enforcing these laws. Similarly, Gender Analysis of Indian Penal Code by Ved Kumari offers a critical examination of the IPC from a gender perspective, highlighting its limitations in addressing the diverse experiences of male and female victims of sexual violence.

Psychological studies, such as "The Psychology of Human Sexuality" by Don Lucas and Jennifer Fox and "The Experience of Sexual Desire" by J. Gayle Beck, offer valuable insights into the psychological correlates of sexual desire and behavior. These studies contribute to our understanding of the complexities surrounding sexual violence and underscore the importance of considering psychological factors in addressing and preventing such offenses.

Feminist scholarship, exemplified by works such as "Status of Women in India: From Ancient to Modern Age" by Pragya Aggarwal and "Memorandum on Reform of Laws Relating to Sexual Offences" by Shomona Khanna and Ratna Kapur, offers critical analyses of gender dynamics and legal frameworks in India. These works advocate for gender-sensitive approaches to law and policy reform, emphasizing the need to address systemic inequalities and empower marginalized communities.

In conclusion, the reviewed literature provides valuable insights into the multifaceted nature of sexual violence against men, legal frameworks addressing sexual offenses, and broader gender dynamics. By synthesizing perspectives from primary and secondary sources, this review contributes to a more nuanced understanding of the subject matter and highlights the importance of adopting inclusive and gender-sensitive approaches to addressing sexual violence and promoting gender equality.

Research Gap

Indian law currently identifies only men as perpetrators and women as victims of rape and sexual assault, leading to injustice for men and transgender individuals who are excluded as potential victims. To ensure equality, the law should be amended to include men and transgender individuals as victims of these offenses.

Research Objectives

- To understand the psyche of Indian society and link the want of proper litigation for sexual offenses against men with the age-old patriarchal mindset of perceiving men as stronger than women
- To analyze the existing laws for men in India and the remedies available to men.
- To understand if there is a need of legislation for the rights of men.

Research Methodology

- The approach will be empirical exploratory research. There will be individual interviews of around 100 men from various states in India to understand the male perspective of sexual assault.
- Further, a google form will be created that will be circulated to 100 men that would require them to express their viewpoints and personal experiences of sexual assault, if any.
- The researcher also intends to travel to some rural areas in India and talk to a minimum of 50 people to understand the psyche of men's rights. Further, a comparison will be drawn to understand the notion of sexual assault on men in rural vis-à-vis the urban areas.

Hypothesis

- Domestic Violence against men in South Delhi is null and therefore the existing legislation is sufficient to address.
- Women are more prone to domestic violence than men.
- The upper-middle class people and educated households are less prone to domestic violence.

Domestic Violence against Men: A Broader Perspective

Domestic violence, or intimate partner violence (IPV), involves behaviors by one partner to exert control over another in an intimate

relationship. This abuse can be physical, emotional, psychological, financial, or sexual. It affects all relationship types, regardless of gender, sexual orientation, or marital status. While traditionally viewed as affecting primarily women, men can also be victims of IPV.

Common Misconceptions about Domestic Violence against Men

Men can and do experience domestic violence in their intimate relationships, contrary to popular belief. Research indicates that a significant number of men suffer from physical, emotional, and psychological abuse by their partners. Societal stereotypes and gender norms often downplay or invalidate these experiences, leading to underreporting and lack of recognition. Abuse isn't determined solely by physical strength; emotional manipulation, psychological coercion, and financial control are commonly used tactics. Male victims may feel trapped due to emotional or financial dependence. Studies, such as the CDC's National Intimate Partner and Sexual Violence Survey, reveal that nearly 1 in 10 men in the U.S. have experienced intimate partner violence.

Challenging Stereotypes: Recognizing the diversity of male victims and their experiences of abuse.

Male victims of domestic violence come from diverse backgrounds, varying in age, sexual orientation, and socioeconomic status. Their experiences differ in severity, duration, and impact. Recognizing this diversity dispels the myth that domestic violence affects only specific demographics. Organizations now provide tailored services, including hotlines, shelters, counselling, and legal aid, to support male survivors.

Challenges in Identifying and Reporting Male Domestic Violence

- **Social Stigma:** Fear of emasculation and ridicule inhibits male victims from seeking help.
- **Legal and Institutional Barriers:** Lack of recognition and support for male victims within existing systems.
- **Underreporting:** Male victims face scepticism and disbelief when disclosing their experiences.
- Stigma and Shame Associated with Male Victimization
- Lack of Awareness and Support Services for Male Victims
- Legal and Institutional Barriers

Legal Landscape

The legal and policy landscape surrounding domestic violence has evolved significantly in recent decades, reflecting society's growing recognition of the prevalence and impact of intimate partner violence. However, while considerable progress has been made in addressing domestic violence against women, there remains a pressing need to examine the legal and policy implications of male victimization. In this section, we will review existing laws and policies related to domestic violence, explore the challenges in addressing male victimization within legal frameworks, and propose recommendations for legislative and policy changes to better support male victims.

Review of Existing Laws and Policies Related to Domestic Violence

In many countries, laws and policies aimed at combating domestic violence have primarily focused on protecting female victims and holding perpetrators accountable. These legal frameworks typically define domestic violence in gendered terms, with provisions for protective orders, support services, and legal remedies tailored to women's needs. While critical in addressing the impact on women, these efforts often overlook male victims. Domestic violence laws vary widely, with some jurisdictions having comprehensive frameworks covering all abusive behaviours, while others have limited definitions that may exclude forms like emotional or psychological abuse against males. Enforcement and support for male victims are often inadequate, complicating efforts within current legal frameworks.

Challenges in Addressing Male Victimization within Legal Frameworks

Several challenges hinder the effective recognition and support of male victims of domestic violence within legal frameworks:

- **Gendered Definitions:** Many legal definitions of domestic violence are framed in gendered terms, focusing primarily on violence against women. As a result, male victims may not meet the criteria for protection or support under existing laws, leading to disparities in access to justice and services.

- **Underreporting and Disbelief:** Male victims of domestic violence often face scepticism or disbelief when disclosing their experiences to law enforcement officials or seeking legal remedies.

- **Limited Support Services:** Existing support services for domestic violence survivors may be tailored primarily to the needs of women, leaving male victims with few resources or avenues for assistance. Shelters, counselling programs, and legal aid services may lack the capacity or expertise to effectively address the unique needs of male survivors, further exacerbating their vulnerability and isolation.

- **Cultural and Societal Norms:** Cultural and societal norms surrounding masculinity may discourage male victims from seeking help or reporting abuse.

Recommendations for Legislative and Policy Changes

To address the challenges in addressing male victimization within legal frameworks, several key recommendations can be considered:

- **Gender-Neutral Definitions:** Revise legal definitions of domestic violence to be gender-neutral, encompassing a broad range of abusive behaviours regardless of the gender of the victim or perpetrator.

- **Training and Education:** Provide training and education for legal professionals, law enforcement officers, and service providers on the dynamics of male victimization and the unique needs of male survivors.

- **Expansion of Support Services:** Expand access to support services for male victims of domestic violence, including shelters, counselling programs, legal aid services, and helplines.
- **Public Awareness Campaigns:** Launch public awareness campaigns to challenge stereotypes and stigma surrounding male victimization, promote help-seeking behaviour, and educate the public about the prevalence and impact of domestic violence on men.

- **Research and Data Collection:** Invest in research and data collection efforts to better understand the prevalence, dynamics, and consequences of domestic violence against men.

- **Collaboration and Coordination:** Foster collaboration and coordination among government agencies, advocacy organizations, service providers, and community stakeholders to develop holistic, multi-sectoral responses to domestic violence against men.

In conclusion, addressing domestic violence against men within legal and policy frameworks requires a comprehensive and multifaceted approach that

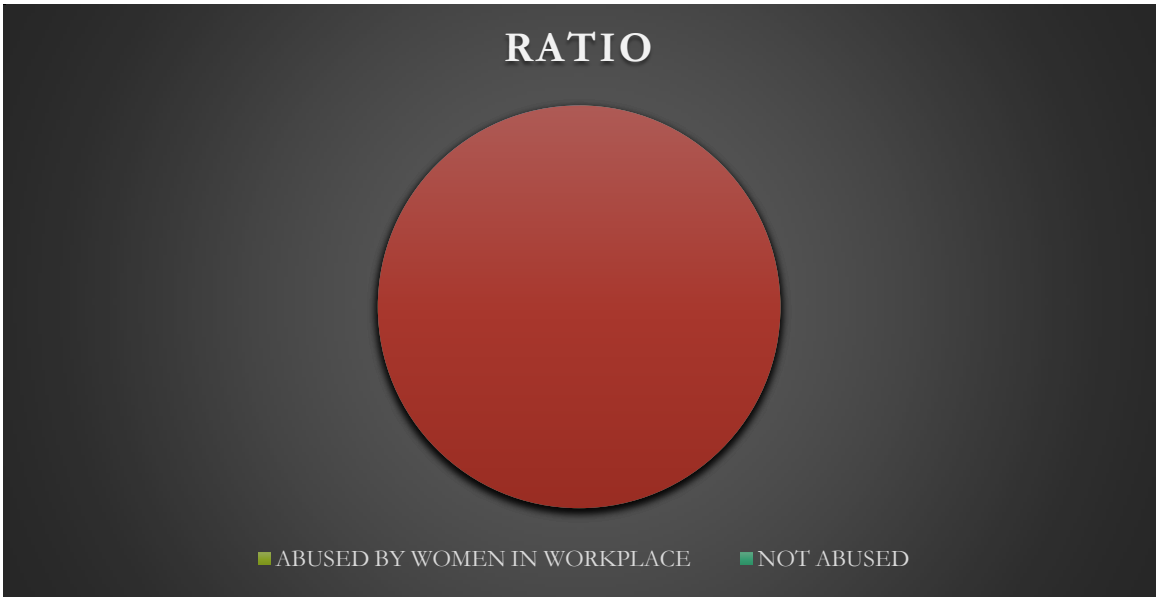
challenges stereotypes, expands access to support services, and promotes systemic change. By adopting gender-neutral definitions, enhancing training and education, expanding support services, launching public awareness campaigns, investing in research, and fostering collaboration, policymakers can better meet the needs of male victims and create a more inclusive and equitable response to domestic violence for all survivors.

Data Analysis

Key Variables:

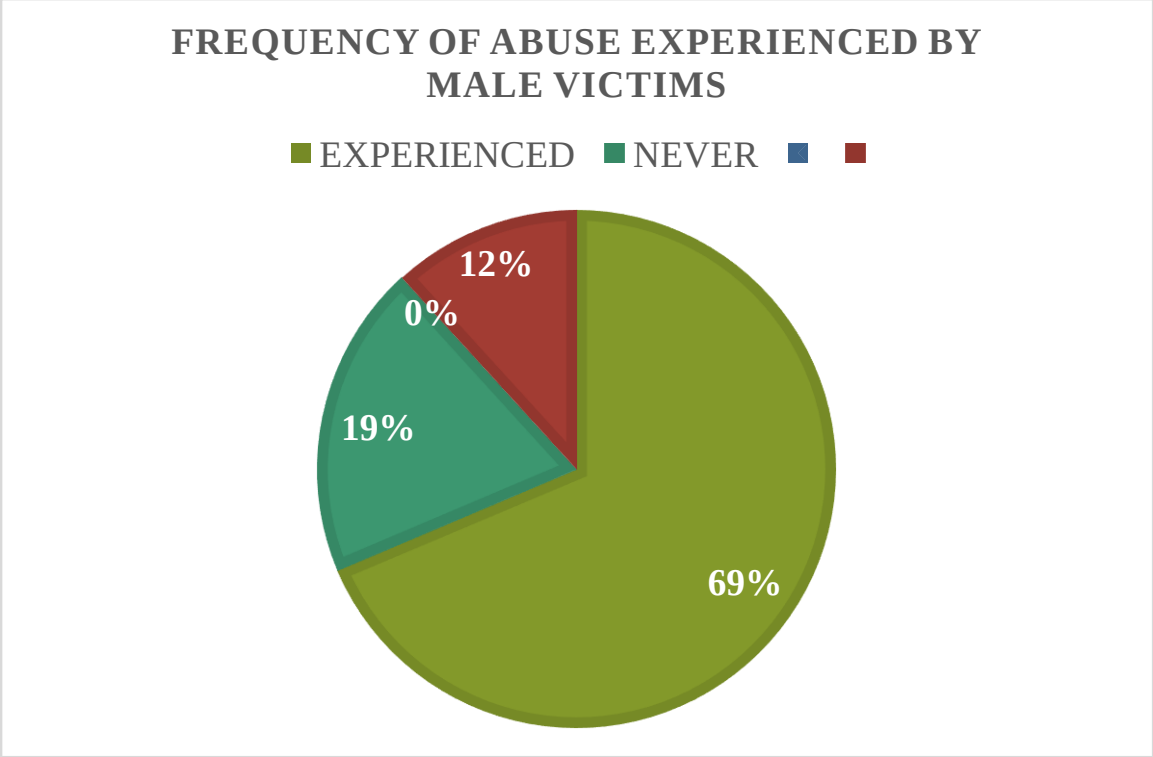
- Types of Abuse: Physical, Emotional/Psychological, Financial, Sexual
- Frequency of Abuse: Never, Rarely, Occasionally, Frequently
- Perpetrator: Intimate Partner, Family Member, Other
- Seeking Help: Yes/No
- Age: 18-25, 26-35, 36-45, 46 and above

Graphical Analysis:



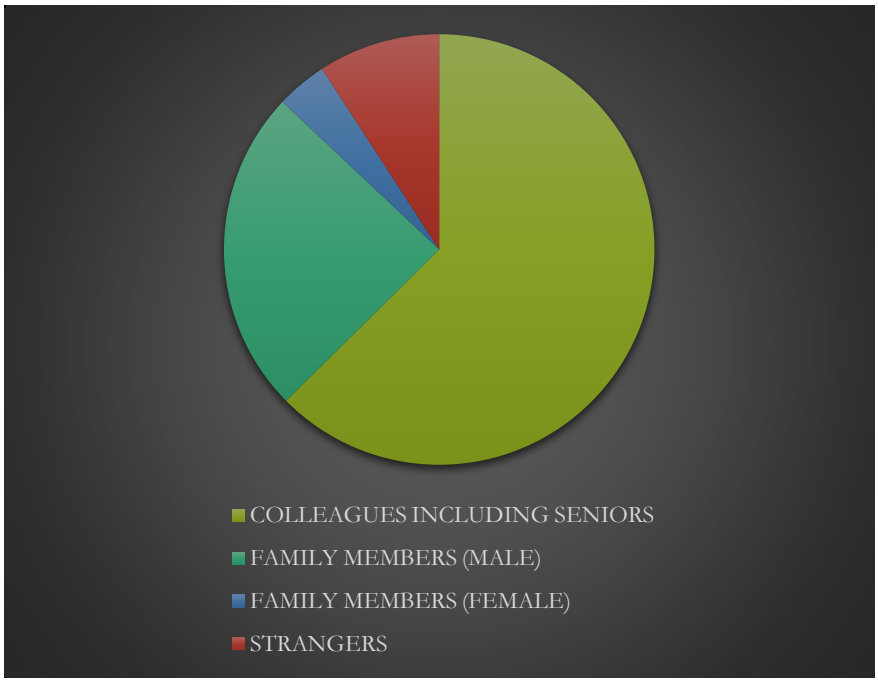
Graph 1: Types of Abuse Reported by Male Victims

This graph illustrates the distribution of different types of abuse reported by male victims in South Delhi.



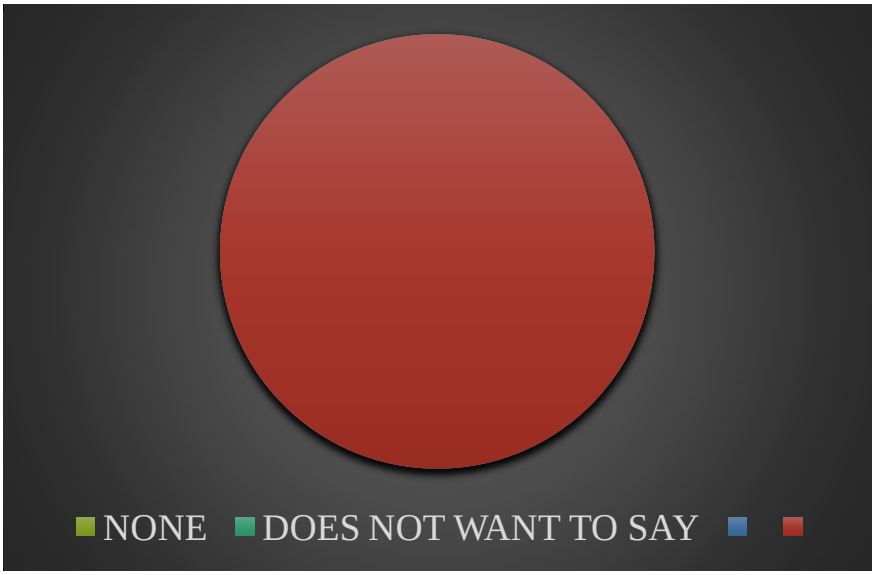
Graph 2: Frequency of Abuse Experienced by Male Victims

This graph depicts the frequency of abuse experienced by male victims in South Delhi, categorized as never, rarely, occasionally, and frequently.



Graph 3: Perpetrators of Abuse Against Male Victims

This graph shows the perpetrators of abuse against male victims in South Delhi, distinguishing between intimate partners, family members, and others.



Graph 4: Percentage of Male Victims Seeking Help

This graph displays the percentage of male victims in South Delhi who sought help after experiencing domestic violence.

Analysis

In South Delhi, as in many other regions worldwide, domestic violence against men remains a significant but often overlooked issue. Despite the prevalence of abuse, many male victims hesitate to report their experiences due to various societal, cultural, and personal barriers. This detailed analysis explores why men in South Delhi may have experienced domestic violence but refrained from seeking help or lodging complaints.

Societal Stigma and Gender Stereotypes

One of the primary reasons why men in South Delhi may not report domestic violence is the pervasive societal stigma surrounding male victimization. Male victims may fear being judged, ridiculed, or emasculated if they disclose their experiences of abuse. This fear of social repercussions can deter men from seeking help or speaking out about their abuse, leading to underreporting and a lack of visibility of male victimization. Traditional gender norms prescribe that men should embody qualities such as strength, resilience, and emotional stoicism. Men are often socialized from a young age to suppress

emotions and vulnerabilities, as expressing feelings of fear, sadness, or helplessness is seen as a sign of weakness. In the context of domestic violence, these expectations of masculinity create a barrier for male victims to acknowledge their experiences and seek help. Victimhood is often associated with passivity, vulnerability, and a lack of agency—traits that are antithetical to traditional notions of masculinity. As a result, male victims may internalize feelings of shame and inadequacy, believing that seeking help or speaking out about their abuse will compromise their status as self-reliant individuals. The fear of being labelled as a victim, and the negative connotations associated with victimhood, can deter men from acknowledging their experiences and seeking support. The pervasive stigma surrounding male victimization of domestic violence also manifests in the fear of judgment and ridicule from others. The fear of not being taken seriously or being met with scepticism can be a significant deterrent for male victims considering seeking help, reinforcing the cycle of silence and invisibility surrounding male victimization. In South Delhi, as in many other societies, societal stigma and gender stereotypes play a significant role in perpetuating the silence surrounding male victimization of domestic violence. Addressing these ingrained attitudes and challenging gender norms is essential to creating a more supportive and inclusive environment for all survivors of domestic violence, regardless of gender. Only by dismantling the stigma surrounding male victimization can South Delhi, and society as a whole, effectively address the issue of domestic violence against men.

Fear of Not Being Believed or Taken Seriously

Male victims of domestic violence in South Delhi may also fear not being believed or taken seriously if they disclose their experiences. There is a common misconception that domestic violence primarily affects women, and men are often met with scepticism or disbelief when they come forward with their stories. This lack of validation can be incredibly disheartening for male victims, who may feel discouraged from seeking help or support. The fear of being dismissed or invalidated further perpetuates the silence surrounding male victimization in South Delhi. The fear of not being believed or taken seriously represents a significant barrier for male victims of domestic violence in South Delhi. In a society where prevailing stereotypes portray men as strong, invulnerable, and incapable of being victims, the idea of male victimization may seem incongruent or even absurd to some. As a result, male survivors of domestic abuse may hesitate to disclose their experiences, fearing that their claims will be met with scepticism, disbelief, or outright dismissal. This fear is compounded by the societal narrative that domestic violence primarily affects women, leading many to question the legitimacy of male victims' experiences. Moreover, male victims may worry about the consequences of not being taken seriously—being further isolated, judged, or even blamed for their own abuse.

The fear of not being believed can be particularly daunting for male survivors who have internalized societal expectations of masculinity, as disclosing their experiences may challenge their sense of identity and self-worth. Consequently, many male victims of domestic violence in South Delhi grapple with the dilemma of whether to remain silent and endure their suffering or risk speaking out and facing potential disbelief or invalidation. This pervasive fear underscores the urgent need for greater awareness, empathy, and validation of male victimization in order to create a supportive environment where all survivors feel empowered to seek help and support without fear of judgment or disbelief.

Cultural Norms and Expectations

Cultural norms and expectations in South Delhi may also contribute to male victims' reluctance to report domestic violence. Traditional patriarchal values often prioritize male dominance and control within intimate relationships, making it challenging for men to acknowledge their vulnerability or seek assistance. Moreover, cultural taboos surrounding discussions of personal matters, especially those related to family dynamics or intimate relationships, can prevent male victims from reaching out for help. The pressure to maintain appearances and uphold family honor may outweigh the need to address instances of abuse, leading to a cycle of silence and inaction.

Lack of Awareness and Support Services

Another significant barrier to reporting domestic violence among men in South Delhi is the lack of awareness and accessible support services. Many male victims may not be aware of the resources available to them or may perceive support services as primarily catering to women. The absence of dedicated helplines, shelters, counseling programs, and legal aid services for male victims further compounds the problem, leaving men with few avenues for assistance. Without adequate support systems in place, male victims may feel isolated and hopeless, believing that there is no help available to them.

Conclusion

In conclusion, men in South Delhi may experience domestic violence but refrain from reporting it due to various societal, cultural, and personal barriers. Societal stigma, fear of disbelief, cultural norms, and lack of awareness about support services all contribute to the underreporting of male victimization. Addressing these barriers requires a concerted effort to challenge gender stereotypes, raise awareness about male victimization, provide accessible

support services, and create a culture of empathy and validation for all survivors of domestic violence, regardless of gender. By dismantling the barriers to reporting and seeking help, South Delhi can create a more inclusive and supportive response to domestic violence that acknowledges the experiences of all survivors, regardless of gender. This entails challenging the harmful stereotypes that perpetuate the myth of male invincibility and the notion that domestic violence is exclusively a women's issue. Education and awareness-raising initiatives are crucial in debunking these misconceptions and highlighting the reality of male victimization. By fostering empathy and understanding, communities can create a culture where male survivors feel validated and supported in coming forward with their experiences. Additionally, addressing the fear of not being believed or taken seriously necessitates the development of comprehensive support systems tailored to the needs of male victims. This includes establishing helplines, shelters, counselling services, and legal assistance programs specifically designed to address the unique challenges faced by male survivors of domestic violence. These support services should be accessible, culturally sensitive, and equipped to provide holistic assistance to male victims, including emotional support, safety planning, legal advocacy, and referrals to other resources.

Moreover, empowering male victims to speak out and seek help requires a commitment to fostering a safe and non-judgmental environment where survivors are treated with dignity and respect. This involves training professionals in law enforcement, healthcare, social services, and other relevant fields to recognize and respond appropriately to male victimization. By creating spaces where male survivors feel validated and heard, South Delhi can break down the barriers to reporting domestic violence and pave the way for healing and recovery. In conclusion, addressing the fear of not being believed or taken seriously is essential in addressing domestic violence against men in South Delhi. By challenging societal stereotypes, providing comprehensive support services, and fostering a culture of empathy and validation, South Delhi can create a more inclusive and supportive response to male victimization. Ultimately, by empowering male survivors to come forward and seek help, South Delhi can work towards ending the cycle of abuse and creating a safer and more equitable society for all.

Harmony through Mediation: Critical Issues in Resolving Global Conflicts and Safeguarding World Peace

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Abstract

In a world marked by diverse perspectives and inevitable conflicts, mediation emerges as a beacon of hope for fostering harmony. This abstract delves into the transformative power of mediation in resolving disputes, be it interpersonal, communal, or international. Through a meticulous process of communication, understanding, and negotiation, mediation transcends adversarial dynamics, offering a platform where conflicting parties can voice their grievances, empathize with each other's perspectives, and collaboratively craft solutions. By promoting active listening, empathy, and compromise, mediation not only addresses the surface manifestations [1]of discord but also delves into the underlying causes, thereby paving the way for sustainable peace and coexistence[2]. This abstract advocates for the widespread adoption and appreciation of mediation as a cornerstone of harmonious cohabitation in an increasingly interconnected and diverse global community.

Keywords: manifestation, mediation, harmony, discord

Introduction

In a world where conflicts arise from diverse perspectives, mediation stands as a beacon of hope, offering a pathway to harmony and resolution. Mediation, as a form of alternative dispute resolution, embodies the essence of understanding, communication, and collaboration. It serves as a powerful tool for transforming discord into dialogue and animosity into amicability.

At its core, mediation is more than just a process; it's a philosophy that embraces empathy, impartiality, and the belief in the inherent capacity for people to find common ground. By fostering open communication and facilitating negotiation, mediation empowers individuals and parties to actively

[1] Manifestations = the public display of emotion or feeling, or something theoretical made real

[2] Coexistence = the state or fact of living or existing at the same time or in the same place.

participate in crafting their own solutions, rather than surrendering to adversarial proceedings.

Literature Review

The literature on mediation spans various disciplines, including law, psychology, sociology, and conflict resolution studies. Scholars and practitioners alike have contributed valuable insights into the theory, practice, and effectiveness of mediation in fostering harmony and resolving disputes.
Key concepts such as active listening, reframing, and interest-based negotiation[3] form the foundation of mediation theory (Folberg et al., 2014).

- Researchers have explored various models of mediation, including facilitative, evaluative, and transformative[4] approaches, each with its unique emphasis on the role of the mediator and the dynamics of the mediation process (Bush & Folger, 2005).

Empirical studies have examined the effectiveness of mediation in different contexts, such as family disputes, workplace conflicts, and civil litigation. Research consistently demonstrates that mediation leads to higher levels of satisfaction, compliance, and long-term resolution compared to traditional adversarial processes (Freeman & Tollefson, 2006).

- Meta-analyses and systematic reviews have provided evidence of the positive outcomes of mediation across diverse settings, highlighting its role in reducing hostility, preserving relationships, and minimizing the economic and emotional costs of conflict (Doherty et al., 2018).

Scholars have explored the influence of culture, power dynamics, and socio-economic factors on the mediation process and outcomes. Understanding cultural nuances, communication styles, and perceptions of justice is essential for ensuring culturally responsive and equitable mediation practices (LeBaron & Pillay, 2006)

[3] Negotiation = strategic discussion between two parties to resolve an issue in a way that both find acceptable.

[4] Transformative = causing a marked change in someone or something

Research Gap

Current State of Conflict Resolution

Research While there has been significant research on conflict resolution and mediation; there is still a gap in understanding the effectiveness of these methods in resolving global conflicts and promoting world peace.

Need for Further Exploration

There is a need for further exploration of the role of mediation in resolving conflicts at the global level, particularly in the context of cultural and political differences

Objectives

Primary Objectives: To identify the key factors that contributes to successful mediation in resolving global conflicts.

Secondary Objectives: To explore the role of cultural differences in the mediation process.To investigate the impact of power dynamics on the success of mediation efforts.

To examine the effectiveness of different mediation Techniques and approaches.

Hypothesis

Main Hypothesis

The use of mediation in resolving global conflicts leads to greater success in achieving long-term peace and cooperation among nations.

Research Methodology

Type of Research: Doctrinal Research

"A doctrinal research means a research that has been carried. out on a legal proposition or propositions by way of analysing the existing statutory. provisions and cases by applying the reasoning power."

- **Doctrine of Settlement:** How legal principles related to settlement agreements or contract law impact the enforceability of mediated settlements.

- **Doctrine of Good Faith:** Exploring how the duty of good faith and fair dealing in contract law informs the behavior of parties during mediation.

- **Doctrine of Confidentiality:** Examining legal rules governing confidentiality in mediation and how they intersect with broader legal principles.

- **Doctrine of Equity:** Considering how equitable principles are applied in mediation to achieve fair and just outcomes.

- **Doctrine of Precedent:** Analyzing how legal precedents influence mediation outcomes and practices.

Case Study: Mediation Efforts in the Russia-Ukraine Conflict

- **Background:** The Russia-Ukraine conflict emerged following Russia's annexation [5]of Crimea in 2014 and the subsequent outbreak of hostilities in Eastern Ukraine. The conflict has since evolved into a protracted crisis involving geopolitical interests, territorial disputes, and complex internal dynamics within Ukraine.

Mediation Process

- **International Mediation Framework:** The mediation process involves the engagement of key international stakeholders, such as the United Nations, European Union, and Organization for Security and Co-operation in Europe (OSCE), to facilitate dialogue and negotiations between Russia and Ukraine.

- **Mediator Selection and Appointment:** A neutral and respected international mediator or mediation team is appointed to facilitate discussions between Russian and Ukrainian representatives. The mediator's role is to foster trust, facilitate dialogue, and identify common ground for negotiations.

- **Agenda Setting and Confidence-Building Measures:** Mediators work with both parties to set the agenda for negotiations, focusing on key

[5] Annexation =possession taken of a piece of a land or a country , usually by force or without permission

issues such as ceasefire arrangements, territorial status, security guarantees, and humanitarian concerns. Confidence-building measures, such as prisoner exchanges and localized ceasefires, are implemented to demonstrate goodwill and build trust.

- **Exploring Diplomatic Solutions:** Mediators facilitate exploratory talks aimed at finding diplomatic solutions to the conflict. This may involve proposing frameworks for conflict resolution, including potential autonomy arrangements for Eastern Ukraine and discussions on Crimea's status.

Outcomes

- **Ceasefire and De-escalation:** Mediation efforts result in a comprehensive ceasefire agreement between Russia and Ukraine, leading to a reduction in hostilities and violence in Eastern Ukraine.

- **Negotiated Settlement:** Mediators help facilitate negotiations leading to a negotiated settlement that addresses key concerns of both parties, including territorial integrity, security guarantees, and political arrangements.

- **International Monitoring and Peacekeeping**[6]**:** Mediators coordinate with international organizations to establish monitoring mechanisms and peacekeeping missions to oversee the implementation of the ceasefire and peace agreements.

Challenges and Considerations

- **Geopolitical Complexities:** Mediation in the Russia-Ukraine conflict requires navigating complex geopolitical interests involving not only Russia and Ukraine but also other regional and international actors.

- **Security Concerns:** Ensuring security guarantees for all parties involved is crucial to sustaining any negotiated settlement.

- **Humanitarian Crisis:** Mediation efforts must address the humanitarian impact of the conflict, including the plight of internally displaced persons, refugees, and civilians affected by hostilities.

[6] Peacekeeping = the preserving of peace

Conclusion

While achieving harmony through mediation in the Russia-Ukraine conflict is challenging, sustained international mediation efforts can contribute to de-escalation, dialogue, and ultimately a negotiated settlement that promotes peace, stability, and reconciliation [7] between Russia and Ukraine. The hypothetical case study underscores the importance of diplomatic engagement, trust-building, and international cooperation in resolving complex conflicts of this nature.

Research Questions and Discussion

- **Exploring the Impact of Mediation on Interpersonal Relationships**

  - How does mediation influence the quality of interpersonal relationships among parties involved in conflict resolution?
  - What are the underlying mechanisms through which mediation fosters empathy, understanding, and trust between conflicting parties?

- **Comparative Analysis of Mediation Models**

  - What are the differences in outcomes and participant satisfaction between facilitative, evaluative, and transformative mediation models?
  - How do the characteristics of each mediation model affect the dynamics of the mediation process and the likelihood of reaching mutually acceptable agreements?

- **Mediation in Cross-Cultural Contexts**

  - How do cultural differences impact the effectiveness and perceptions of mediation outcomes?
  - What strategies can mediators employ to address cultural barriers and promote cultural sensitivity and inclusivity in mediation practices?

- **The Role of Emotions in Mediation**

  - How do emotions influence the negotiation process and outcomes in mediation?

[7] Reconciliation = the act of causing two people or groups to become friendly again after an argument or disagreement.

- What techniques can mediators utilize to effectively manage and address emotions during mediation sessions, enhancing the likelihood of successful resolution?

➢ **Mediation and Power Dynamics**

- How do power imbalances between parties affect the mediation process and the fairness of outcomes?
- What strategies can mediators employ to mitigate power differentials and ensure equitable participation and decision-making among all parties involved?

➢ **The Impact of Technology on Mediation**

- How does the integration of technology, such as online mediation platforms and video conferencing tools, affect the dynamics and outcomes of mediation?

Analysis of Legal Issues

➢ **Confidentiality and Privilege**

- One key legal issue in mediation is the protection of confidentiality [8] and privilege. Parties often disclose sensitive information during mediation sessions with the expectation that it will remain confidential. However, there may be instances where courts compel disclosure of information exchanged during mediation, raising questions about the extent of confidentiality and the applicability of privilege laws.

➢ **Enforceability of Agreements**

- Another legal consideration is the enforceability [9] of agreements reached through mediation. While mediation can result in mutually acceptable resolutions, there may be concerns about the legal validity and enforceability of these agreements, particularly if they are not formalized in writing or if they conflict with statutory or contractual provisions.

➢ **Mediator Neutrality and Impartiality**

- Mediators are expected to maintain neutrality and impartiality throughout the mediation process. However, there may be instances

[8] Confidentiality= the state of keeping or being kept secret or private

[9] Enforceability = the fact that a law or rule is enforceable

where allegations of bias or conflicts of interest arise, raising questions about the mediator's integrity and the fairness of the mediation proceedings.

- **Informed Consent and Voluntariness**

  - Informed consent and voluntariness are essential principles in mediation. Parties must enter into mediation voluntarily and with a clear understanding of the process and its implications. Legal issues may arise if parties feel coerced or pressured into participating in mediation or if they are not adequately informed about their rights and options.

- **Mediation and Legal Rights**

  - Parties involved in mediation must be aware of their legal rights and obligations. There may be concerns about whether parties fully understand the legal consequences of their decisions during mediation, particularly in cases involving complex legal issues or asymmetric power dynamics.

- **Mediation in Court-Annexed Programs**

  - Court-annexed mediation programs raise legal issues regarding the intersection of mediation with the formal judicial system. Questions may arise about the extent of judicial oversight, the enforceability of mediated agreements, and the role of mediators in facilitating access to justice while upholding procedural[10] fairness.

Addressing these legal issues requires careful consideration of applicable laws, ethical standards, and best practices in mediation. It also underscores the importance of ensuring transparency[11], fairness, and accountability in the mediation process to uphold the integrity of the legal system.

Limitations

- **Voluntary Participation:** Mediation relies on the voluntary participation of all parties involved. If any party refuses to engage in the mediation

[10] Procedural = something related to a required or standard course of action.

[11] Transparency = the quality of being easily seen through, while transpar

process or is unwilling to compromise, achieving a resolution becomes challenging.

- **Power Imbalance:** In some cases, there may be a significant power imbalance between the conflicting parties, which can hinder the effectiveness of mediation. The party with more power may dominate the negotiation process, making it difficult to reach a fair and equitable agreement.

- **Cultural Sensitivity:** Mediators must navigate diverse cultural norms, values, and communication styles. Without adequate cultural sensitivity and understanding, mediation efforts may inadvertently perpetuate misunderstandings or exacerbate tensions.

- **Legal Enforcement:** Unlike formal legal proceedings, mediated agreements are not always legally binding. If one party breaches the agreement, enforcement mechanisms may be limited, leading to potential disputes or re-escalation of conflict.

- **Complex Issues:** Some conflicts involve deep-seated issues, historical grievances, or multifaceted[12] dynamics that cannot be easily resolved through mediation alone. In such cases, additional interventions or long-term reconciliation processes may be necessary.

Conclusion

In conclusion, the exploration of mediation as a pathway to harmony has revealed its profound significance in resolving conflicts, fostering understanding, and promoting collaboration. Through its principles of communication, empathy, and empowerment, mediation offers a transformative approach to conflict resolution that transcends cultural boundaries and legal frameworks.

From the theoretical foundations of mediation to its practical applications in diverse contexts, research has illuminated the effectiveness of mediation in facilitating constructive dialogue, preserving relationships, and minimizing the costs of conflict. However, the journey of mediation is not without its challenges, as legal issues surrounding confidentiality, enforceability, and mediator neutrality underscore the need for careful consideration and ethical practice.

[12] Multifaceted = means having many aspects or sides

Despite these challenges, the potential of mediation to cultivate harmony remains undeniable.[13] By embracing diversity, promoting inclusivity, and upholding principles of fairness and justice, mediation stands as a beacon of hope in an often tumultuous[14] world. As we continue to explore and refine our understanding of mediation, let us remain committed to harnessing[15] its transformative power to build a more harmonious and peaceful society for generations to come.

Suggestions

Certainly! Here are some suggestions for further exploration or action regarding the topic of mediation and harmony:

- **Expand Research Horizons:** consider delving deeper into specific aspects of mediation, such as its application in specific industries (e.g., healthcare, education) or its intersection[16] with other disciplines (e.g., psychology, economics). Exploring emerging trends or innovative practices in mediation can also provide valuable insights.

- **Case Studies and Practical Applications:** Conduct case studies or interviews with mediators, parties involved in mediations, or organizations implementing mediation programs to gain practical insights into real-world applications, challenges, and successes.

- **Training and Skill Development:** If interested in becoming involved in mediation professionally, consider pursuing training or certification programs in mediation. Developing mediation skills through workshops, internships, or volunteer opportunities can enhance understanding and proficiency in the field.

- **Advocacy and Awareness Campaigns:** Raise awareness about the benefits of mediation and advocate for its use as a preferred method of conflict resolution in communities, organizations, and policy-making circles. Organize workshops, seminars, or informational sessions to educate others about mediation's potential to foster harmony and collaboration.

[13] Undeniable = in a way that is certainly true

[14] Tumultuous = full of tumult or riotousness ; marked by disturbance and uproar

[15] Harnessing = to attach by means of a harness

[16] Intersection = a place or area where two or more things (such as streets) intersect

- **Collaborative Projects:** Collaborate with researchers, practitioners, or organizations working in the field of conflict resolution and mediation to initiate joint research projects, develop resources, or organize events aimed at advancing knowledge and practice in mediation.

- **Policy Reform and Advocacy:** Advocate for policy reforms that promote the integration of mediation into legal systems, workplace environments, and community settings. Highlight the cost-effectiveness, efficiency, and positive outcomes associated with mediation as a viable alternative to traditional litigation or adversarial[17] approaches.

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[17] Adversarial = involving two people or two sides who oppose each other

A Study on the Role of NGO's in Empowering Women

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Abstract

In India, despite substantial governmental efforts to foster gender equality, a persistent gender gap persists, posing challenges to women's access to resources and opportunities. This article delves into the multifaceted issue of gender inequality, discussing its extent, root causes, and repercussions, while also proposing policy measures for mitigation. Central to these efforts is the pivotal role of non-governmental organizations (NGOs) in empowering women. Through various interventions, NGOs serve as catalysts for women's socio-economic advancement, playing a crucial role in societal transformation. This study underscores the critical importance of NGO-led initiatives in addressing gender disparities and advancing women's rights and opportunities in India.

Keywords: NGO, Women, Women Empowerment, India, Development.

Introduction

Both in the family and in society, women are significant. About half of the world's population is women who are supposed to contribute half of the world's economic, social, and political input but it's not happening in reality. In India, where patriarchy has long prevailed, women's roles are subordinate in every household. In any community, women's empowerment is vital, particularly in underdeveloped regions. Through a number of laws encouraging women's engagement in politics and education, the Indian government has demonstrated since the 1980s that it is increasingly concerned with issues pertaining to women (Collier, 1998). Women have been recognised as a major force behind sustainable development since the 1990s, and their equality and empowerment are now considered to be top priorities. issues through a range of laws encouraging women's engagement in politics and education (Collier, 1998). Women have been recognised as a major force behind sustainable development since the 1990s, and their equality and empowerment are now considered to be top priorities. In addition to designating 2001 as the Year of Women Empowerment, the Indian government made the advancement of women one of the main goals of the Ninth Five Year Plan (1997–2002). The only ways to empower women are through education, training, and job opportunities.

A social process known as empowerment encourages individuals to take part in taking charge of their lives in their communities. It is a multifaceted, all-encompassing strategy that aids women in achieving self-realization and power so they can raise their standards of living. Empowering women entails changing the political, social, psychological, and economic facets of existence. Non-governmental organisations (NGOs) are seen as a crucial instrument for women's empowerment in India. It takes women's empowerment in social, political, economic, and legal spheres to transform society into one that is advanced. Governments, non-governmental organisations, and international agencies have been aware of and concerned about the situation of women for a number of decade Organisations working to empower women in need can be found in a variety of contexts, such as the political, social, cultural, economic, and psychological. NGOs give women the tools to advance economically and also give them the chance to become more powerful socially and politically in their families and communities. It is important to look at how NGO assistance affects women's development, particularly in underdeveloped countries. A significant body of literature has been written about women's empowerment, and a small number of studies have examined the advancements achieved in this area by non-governmental organisations.

Gender Equality

The most crucial element in ensuring gender equality and empowerment is education. Gender parity in education is attained through the enrolment of females in elementary education, their survival, and their advancement to higher education levels. Gender plays a significant role in development. It is a method of examining how opportunities and lives of various groups of men and women are impacted by social norms and power systems. More women than men are impoverished worldwide. Lack of education typically causes individuals to have a number of issues. Mothers without formal education often do not know what is best for their children in terms of nutrition. According to the study, women with lower educational attainment had less influence over their families' food choices, supported attempts to eat healthily less, had fewer opportunities to observe and learn good food-related practices, more perceived environmental constraints, and more ambiguous beliefs about the benefits of eating a nutritious diet than women with higher educational attainment. Women who are not educated are either pressured or pushed to marry young because they lack the self-assurance and information to make their own decisions. With over 24 million child brides, India has the sad distinction of having the highest total number of child brides. This amounts to 40% of the 60 million child marriages that occur worldwide. Girls who marry young are sometimes forced into adulthood and motherhood before they are emotionally or physically ready.

Financial Help/ Funding

Since women comprise the majority of the world's impoverished, targeting women and their economic empowerment is essential to achieving goals for reducing poverty.

It is inefficient economically to discriminate against women. When a significant portion of the population is unable to compete fairly or reach their full potential, national economies suffer.

Collaborating with females is a wise business decision. Women may contribute to the expansion of markets and enterprises when they are given the proper tools and chances.

Empowered women make greater contributions to their families, communities, and countries' economies. An NGO for women can implement various initiatives, such as vocational training, entrepreneurship programs and microfinance projects, to enable women to become economically independent. By fostering financial literacy and creating opportunities for sustainable income generation, these organizations contribute to reducing the economic disparities between men and women. The funding agencies not releasing the funds in time, insufficient funds allocated for the activity and people not donating generously were the main problems in the area of finance. The other problems of comparatively less importance were not aware of procedure for getting funds and do not know how to raise own funds. Unable to allocate funds properly was also an important problem of NGOs. Corruption within NGOs can damage their reputation and erode public trust. Donors may become hesitant to contribute funds, and beneficiaries may question the integrity of the organization. This loss of credibility can hinder the NGO's ability to attract support and achieve its objectives.

Literature Review

There is by now a large literature on the impact of NGOs on women's empowerment. The study is a modest effort to assess the impact of NGO on the purpose of women empowerment. The following literature has been reviewed for the present study to examine the role of NGOs on women empowerment:
Journal of International Development, (Kabeer, Naila 2005) proposes a theoretical framework for understanding the role of NGOs in women's empowerment. It discusses how NGOs can act as intermediaries between women and formal institutions, empowering women through a rights-based

approach and promoting gender equality through various programs and initiatives.

Gender Mainstreaming in NGO Funding: Challenges and Opportunities (Singh, Ravi and Patel, Meera, 2016) This study discusses the challenges faced by NGOs in securing financial support for gender equality projects and mainstreaming gender perspectives in funding criteria. It explores the biases and barriers that hinder women-led organizations from accessing adequate resources and highlights best practices for donors and funders to prioritize gender-responsive funding mechanisms. The study calls for greater transparency, accountability, and inclusivity in funding processes to support sustainable and impactful gender equality initiatives.

Margaret (2012) examined the impact of NGO interventions on the empowerment of women in Addis Ababa (Ethiopia) and Chennai (India)". The findings of the study revealed high empowerment of beneficiary women could take place in the economic, cultural, social and psychological walk of life. There was a significant difference in the level of empowerment before and after NGOs intervention, it was quite positive. Active participation of NGOs is necessary for bringing women empowerment in rural areas.

In a research study by J. Saritha in 2015 on "Performance of NGOs with special reference to Women Empowerment", conducted at Telangana state. Here the researcher stated that since pre-independence non-government organizations in India have been playing a crucial role in society building. Over the two decades, NGOs are concerning on issues related to legal right, women empowerment, environmental protection, poverty etc. Today most of the NGOs are working for rural development. Women's issues are an important concern of NGOs, this resulted into the establishment of National and State commission for Women. Social welfare is a major responsibility of NGOs, so the welfare of women and child are important area covered by NGOs. The strength of NGOs depends upon the utilization of existing government schemes and economic assistance.

African Journal of Gender Studies (Ojo, Fatima and Kamau, Grace, 2017) research evaluates the effectiveness of donor funding in advancing gender equality outcomes in sub-Saharan Africa, focusing on the contributions of international aid agencies and philanthropic foundations to NGO-led initiatives. It assesses the sustainability, scalability, and long-term impact of donor-supported projects on women's rights, economic empowerment, and social inclusion. The study identifies key success factors and challenges in leveraging external funding for gender equality programs and calls for greater coordination and collaboration among donors and NGOs to maximize impact.

Financial Sustainability of Gender Equality NGOs (Lee, Samantha and Wong, David, 2015) article examines the financial sustainability challenges faced by gender equality NGOs, exploring strategies for diversifying funding sources, building partnerships, and enhancing organizational resilience. It discusses the importance of financial planning, risk management, and impact measurement in attracting and retaining donors, supporters, and investors. The study showcases case studies of successful NGO models that have effectively balanced financial sustainability with social impact, offering insights for practitioners, policymakers, and funders interested in supporting gender equality initiatives.

Intersectionality and Funding Priorities in Gender Equality NGOs (Chen, Wei and Patel, Nisha, 2020) research investigates the role of intersectionality in shaping funding priorities and resource allocation within gender equality NGOs. It examines how factors such as race, class, sexuality, and disability impact funding decisions and programmatic focus in women's rights organizations. The study provides insights into the challenges faced by marginalized communities in accessing financial support and offers recommendations for donors and funders to adopt inclusive and equity-centred grant making practices.

Innovative Financing Models for Gender Equality (Innovative Financing Models for Gender Equality, 2018) research examines the potential of impact investing as a novel financing model for advancing gender equality goals. It explores how impact investors can support women entrepreneurs, social enterprises, and grassroots organizations through tailored funding mechanisms that prioritize both financial returns and social impact. The study showcases examples of gender-lens investing initiatives and presents guidelines for donors, investors, and NGOs interested in leveraging innovative financing solutions to drive inclusive and sustainable development outcomes.

Research Gap

The present research paper addresses the corruption, finance help and funding in the NGOs. Research on how NGOs get the findings to make it work. The impact of not getting findings on time can always be a tough situation for them. Notable gap in the literature regarding the corruption in the NGOs which are working towards gender equality and women's empowerment specially gets affected. This research gap suggests the study on how the corruption in these types of NGOs can be stopped and what are the things that are needed to do so that the initiatives of these Women NGOs get to more and more people.
By addressing this research gap scholars can provide a proper insight into the information of corruption, gender equality, and most importantly women

empowerment. This can further contribute to a more effective approach in promoting gender equality and rights and opportunities of women globally.

Objectives

- To understand the key components of women's empowerment.
- To understand role and function of NGOs in promoting gender equality.
- To understand role and function of NGOs in promoting Women Empowerment.

Hypothesis

- Women's empowerment is likely influenced by key components such as education, economic opportunities, political participation, healthcare, legal rights, and social support systems.

- NGOs are expected to play pivotal roles in promoting gender equality by advocating policy changes, conducting awareness campaigns, and providing resources and support to marginalized communities, thereby challenging traditional gender norms.

- NGOs likely serve as catalysts for women's empowerment by implementing targeted programs addressing barriers to education, healthcare, employment, and decision-making roles, while advocating for policies conducive to gender equality and fostering support networks.

- Strategic fund management and transparent allocation increase donor confidence in the effectiveness of their contributions to women's empowerment.

- NGOs with focused missions on women's empowerment, education, and gender equality are more likely to attract funds, reflecting donor alignment with their goals.

Research Methodology

The type of research that was conducted was descriptive research, which aimed to provide a detailed account of a phenomenon. The target sample for the research was women who were associated and working with NGOs. The sampling technique that was used was purposive sampling, which involved selecting individuals who met specific criteria. In this case, we visited two NGOs for the study; sector 57 Shubam Tyagi foundations, Gurugram and

Palam Vihar chowk, school of excellence NGO. The researchers interviewed 13 women who were associated and working in the foundation. Questionnaires were used as a tool to collect data. Questionnaires are a commonly used method of data collection in research, as they are easy to administer and can gather a large amount of data in a short amount of time. Overall, the aim of the descriptive research was to gain a better understanding of the experiences of women associated with NGOs through the use of purposive sampling and questionnaires.

Findings/Results

Below are the results of the questions asked from survey questionnaire to the women of the NGOs as per given in Table 1

- **Age Group Variations:** The histogram graph presents the distribution of women across different age groups, indicating a varied representation of age groups among the interviewed women. An in-depth analysis of the age distribution offers insights into demographics and potentially sheds light on the unique needs and challenges of women in different age brackets.

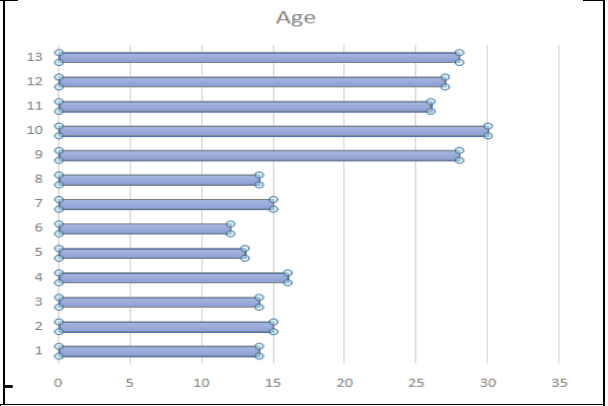
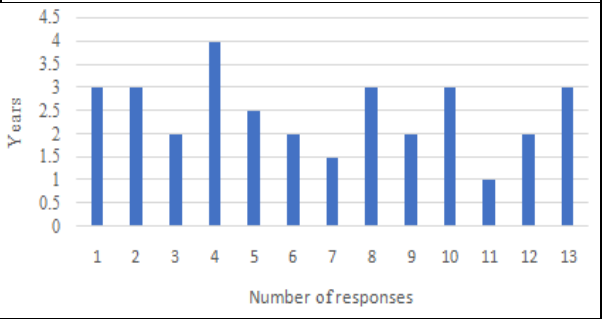
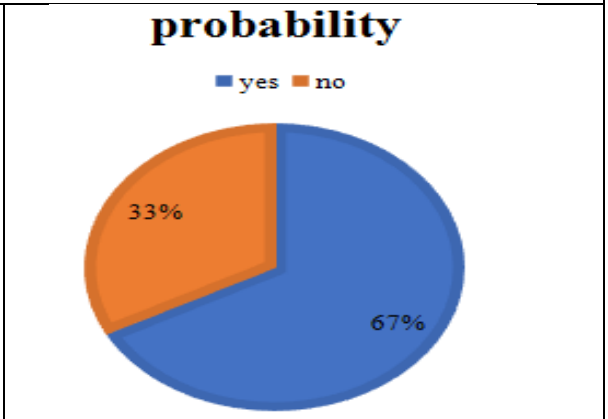
- **Number of Years You Are Part of This NGO**: This histogram illustrates the duration of women's involvement with the NGO, potentially indicating their loyalty or commitment to the organization. Understanding this distribution aids in evaluating retention rates and the long-term impact of the NGO's programs on its members.

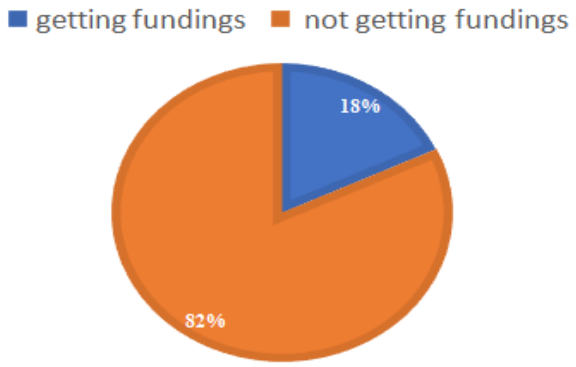
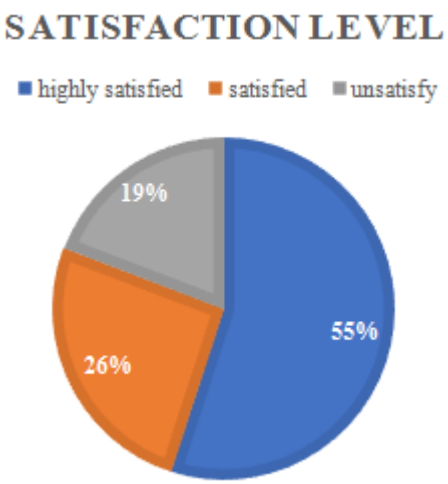
- **Do NGOs Provide Help Women to Develop New Skills and Gain Financial Independence**: According to the pie chart, 67 percent of respondents agreed, while 33 percent disagreed. The chart assesses whether NGOs offer skill development opportunities to women, providing an overview of their contribution to enhancing women's capabilities and economic independence. A higher percentage signifies effective programs aimed at economically empowering women.

- **Number of Women Who Are Self-Earning**: According to the pie chart, 82 percent do not receive funding, while 18 percent do. This chart illustrates the proportion of financially independent women, possibly supported by the NGO. It highlights the success of the NGO's efforts in promoting self-sustainability among women, with a higher percentage indicating a positive impact on women's economic empowerment.

- **Satisfaction Level of the Women:** The satisfaction level pie chart reveals that 55 percent are highly satisfied, 19 percent are unsatisfied, and 26 percent are satisfied. It reflects women's overall sentiment towards the NGO's programs, indicating the effectiveness of its initiatives in meeting their needs and expectations. A high satisfaction level suggests successful addressing of challenges and requirements, indicating the NGO's significant role in supporting women's development, providing skills training, fostering financial independence, and generating satisfaction among its members.

Table-1

Questions	Descriptions	Percent distribution (Bar/Pie chart)
Age Group Variations	This histogram graph represents the various age groups of women, who were interviewed, with each bar indicating The number of Per-centage of Participants in each age bracket.	
Number of years you are part of this NGO	This histogram graph represents that from how many years the women's are the part of the NGO.	
Do NGOs provides help women to develop new skills and gain financial independence	This pie chart represents that the NGOs provides skills to women's or not.	

Number of women's who are self-earning	This pie chart represents the fundings in NGOs.	
Satisfaction level of the women's	This pie chart Represents that the Satisfaction levels of the women about the NGOs program.	

Delimitations of the Study

- The study is limited to Gurugram city only.
- The study is limited to 2 NGOs of Gurugram.

Conclusion

Non-governmental organizations (NGOs) play a crucial role in addressing local needs and promoting social change. With their flexibility, ability to innovate, and focus on specific issues, NGOs effectively mobilize resources and respond to community needs. While their reliance on private funding can pose challenges, their impact on empowering women and advancing social causes is undeniable. In India, NGOs are increasingly vital in promoting women's empowerment and addressing gender disparities. Through various initiatives such as education, leadership development, and skill training, NGOs contribute to enhancing women's economic, social, and political participation. This empowerment leads to tangible improvements in women's lives, enabling them to make independent decisions and contribute meaningfully to their families and communities. Among the noteworthy NGOs in Gurugram, the Shubam Tyagi Foundation in Sector 57 and the School of Excellence in Palam Vihar Chowk stand out for their impactful work. These

organizations provide women and girls with valuable skills and knowledge, empowering them to seize opportunities for their future. The dedication and care provided by the foundation's workers contribute significantly to the positive development and transformation of women's lives.

Educational Implications

The experiences observed with NGOs like the Shubam Tyagi Foundation and the School of Excellence underscore the importance of educational initiatives in empowering women. These organizations serve as models for effective approaches to women's empowerment through education and skill development.

Educators and policymakers can draw valuable lessons from these NGOs in designing educational programs that cater to the needs of women and girls. By emphasizing skill-based training, leadership development, and access to resources, educational institutions can foster greater gender equality and empowerment.

Moreover, collaboration between educational institutions and NGOs can amplify the impact of empowerment initiatives. By leveraging the expertise and resources of both sectors, comprehensive support systems can be established to address the multifaceted needs of women and girls.

Overall, the success stories witnessed in Gurugram highlight the transformative power of education in empowering women and driving social change. By prioritizing educational empowerment initiatives, societies can create more inclusive and equitable environments for women to thrive.

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Awareness of Various Schemes under Beti Bachao Beti Padhao: A Study of Haryana

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Abstract

Beti Bachao Beti Padhao is a government social scheme launched by the Prime Minister Narendra Modi in order to address the gender imbalance and discrimination against girl child in the Indian society. This study investigated the awareness level of people about BBBP campaign and perception of people regarding BBBP campaign. This study is to aware people about the importance of girls in the society. It is to increase awareness among common people to save the lives of girl child by completely removing the female foeticide. This scheme was the urgent need of today's time as without saving and empowering women of the country, development is not possible at all. Women cover around half population of the country so they are half power of the country. That's why they need equal rights, facilities and opportunities to go ahead and contribute to the development of India. The study is theoretical as well as practical. This study is based on primary and secondary data sources. The results of the study showed that people do have some basic understanding of the BBBP campaign and its motto while BBBP campaign was also found to have a strong positive impact on the sex ratio of children. People also think that if women are given equal opportunities, it will lead the country to development. This study used a mixed method approach.

Introduction

Beti Bachao Beti Padhao means save the girl child and educate her. It is a government initiative that was started to increase awareness towards the value of the girl child, to prevent gender-based discrimination and to encourage education for girls.

Our honourable Prime Minister Shri Narendra Modi had introduced the Beti Bachao Beti Padhao campaign in Panipat, Haryana on January 22, 2015. It was introduced because of the drastic downfall in the Child Sex Ratio (the number of girls per thousand boys) in 2011. The child sex ratio (0-6 years) in India was 927 girls per 1000 boys in 2001 which was drastically dropped to 914 girls pee thousand boys in 2011. For this low child sex ratio UNICEF in its report of 2012 had ranked India at 41st position among 195 Countries which

was a reason for greater concern towards the girl child. The declined CSR is the major indicator for women's disempowerment. The major cause of low CSR was on the one hand, the sociocultural structure discriminates against women; on the other, since 1961, there has been no end to the ease of access to diagnostic devices, as well as their misuse.

Women and Child Development, Health and Family Welfare, and Human Resource Development are the three ministries involved in the BBBP initiative. A "call to action" campaign was organised for July 2015 with the goal of spreading the BBBP message widely. The state prime minister, the US ambassador to India, the UNICEF country representative for Haryana, and Bollywood star Ms. Parineeti Chopra were among those in attendance. On August 26, 2016, Sakshi Malik, the 2016 Olympic bronze winner, was appointed as the brand ambassador for BBBP. The state-level Haryana Diwas was celebrated as the Beti Diwas in November of 2015.

In order to save and educate female children or raise public awareness in society, the national, state, district, and municipal levels of government launched the BBBP campaign. The girls will become independent and financially secure as a consequence.

Government Initiatives

- Sukanya Samriddhi Account Scheme.
- Ladli Laxmi Yojna.
- No school fees for girls in Government schools.
- Haryana Kanya Kosh.
- Women helpline Scheme.
- Mahila Shakti Kendra (MSK).

Significane of the Report

This is a pilot study which is necessary for increasing the level of awareness about BBBP campaign especially among rural areas. This study is also significant for filling the research gap we found during the study. This study is also important for realizing the girls of their self-worth, by making them literate which will make them employed. Despite the overall positive assessment of the scheme, there exist gaps in terms of budgetary planning and lack of monitoring. The committee found that the overall utilisation of funds under the scheme was below par. therefore there is a need of conducting the study for finding the loopholes in the administration of government where is the actually gap lying between making and implementation of the scheme. Therefore, all these measures make the study very significant.

Literature Review

Dutta P. (2014) conducted a study on Bankura District of West Bengal on Women Empowerment. According to him, women face violence both outside and at home. West Bengal alone saw an 18% increase in domestic violence cases between 2011 and 2012.

Tewari Shweta (2017) conducted a study on "Beti Bachao Beti Padhao, Geographical Analysis of Child Sex Ratio in Mumbai". Maharashtra has shown a downward trend since the 1981 census, with more girl children lost in rural areas than Maharashtra, about 4.69 million girls.
Prathiba (2017) stated in his research that "Women empowerment can be achieved through education, awareness of women's rights, physical security and strict policies".

Vishal Malhotra (2019), examined the overall impact of BBBP, including its impact on women's safety. It explored government initiatives that address security issues in physical and online environment. The paper discussed the changing role of government in providing a safer environment for women.

Research Gaps

- ***Community Perception and Involvement:*** Limited exploration of how local communities perceive and actively engage with Beti Bachao Beti Padhao in Haryana.

- ***Role of Private Sector and NGOs:*** Lack of research on the roles played by private sector entities and NGOs in the implementation and success of Beti Bachao Beti Padhao in Haryana.

Objectives

The study is conducted to achieve the following specific research objectives:

- To know the awareness level of people about BBBP campaign.
- To know the perception of people about the motto of BBBP campaign.

Research Methodology

- The Study is descriptive in nature.
- The Study is based on the primary data and secondary sources. • The Brief information about Beti Bachao Beti Padhao Scheme and its various components are collected from Books, Journals, Internet Source or related topic.

- Residents of Gurugram constitute the sampling unit for the study.
- Systematic sampling has used to collect the data.
- Primary data which has been collected through Focus group discussions & survey through a Questionnaire.

Pilot Study

- People have a basic understanding of the BBBP campaign and its motto.
- People know that this campaign started because there are fewer girls than boys.
- It is a socio-cultural and religious prejudice that society favours male children. This turned out to be the main reason for the low sex ratio in children.
- The BBBP campaign was found to have a strong positive impact on the sex ratio of children.
- Due to the BBBP campaign, the survival and protection of girl child have increased. Beti Bachao-Beti Padhao campaign has a remarkable effect on a girl's education.
- After the campaign, there is a measurable increase in the number of girls going for education.
- It is found that the BBBP campaign is more impactful in the young generation in comparison to the old generation. Because the awareness level is high among the new generation.
- BBBP campaign is influencing social mindset of people. So, people think that the status of girls is the same as that of boys.
- People think that if women are given equal opportunities, it will lead the country to development

The BBBP campaign changed society's perception of girls. They come out of their prejudices.

Findings of the Report

Objective 1: To know the awareness level of people about BBBP campaign.

- When the data was analysed, it was revealed that 94% of the people had already heard about the BBBP campaign.

- While the findings have revealed that major population have already heard about BBBP campaign, but the other findings revealed that 43.3% of the people out of who have heard about BBBP campaign are very well informed about its benefits, but 44.8% people are moderately informed

about its benefits and objectives, while the 10.4% are slightly informed about the campaign and its objectives.

- The survey revealed 92.5% people believe in equal opportunities for girls and boys in all aspects of life which means that there is a very small number of populations who do not believe in equal opportunities for girls and boys and all aspects of life. And because this is very small number therefore, by making little more efforts we can also turn this major number of 92 .5% into 100 percent.

- The survey also revealed that there are 73.1% people who believe that primary objective of the BBBP campaign is to address the societal biasness towards male children and improve the child sex ratio, which is very true. This shows that good number of population is aware of the primary objective of BBBP campaign, which is the indication of moving towards the path of success of the campaign.

- The other findings revealed that 79. 1% says that younger generations are more positively influenced by BBBP campaign compared to older generations and the rest of the people says that there might be a possibility that younger generations are more positively influenced by BBBP campaign compared to the older generation.

- 73.1% people believe that BBBP campaign has increased the survival and protection of the girl child in our community and 22.4% people believe that it might be possible that BBBP campaign has increased the survival and protection of girl child in our community, but they are not sure about it. While the rest did not agree that BBBP campaign has increased survival and protection of girl children in our community.

- 35.8% people believe that there is an increase in the number of girls pursuing education in our community after the BBBP campaign while 26.9% are neutral on this matter and 11.9% people refuse about the increase in the number of girls pursuing education in our community after the BBBP campaign while 20.9% people is highly about increase in the number of girls pursuing education in our community after the BBBP campaign while the rest disagree about the things.

- 44.8% people agree about BBBP campaign has been successful in encouraging people to overcome prejudices against the girl child and 17.9% are highly confirmed about this idea, while 22.4% are neutral on this idea and rest did not agree about the things.

- 82.1% people believe that providing equal opportunities for women as promoted by BBBP campaign is crucial for the progress of the country.

- 77.6% people witnessed a noticeable change in how society perceived the girl child due to BBBP campaign. This means our campaign is working in around the surroundings with high motivity along strong purposes and showing effects in the society.

- 47.8% people agree about that BBBP campaign has contributed to changing societal perceptions regarding the status of girl child.

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Literature, Cinema and Literary Adaptations: Exploring the Ramayana from the Lens of Camera

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Abstract

Literature spans written expressions of human experiences. Literary adaptation transforms these works into films, plays, or other forms. Over centuries, literature has evolved, delving into universal themes. Adaptations modify narratives for new mediums, reshaping stories for broader audiences. The present proposal concentrates on the mythological fiction *The Ramayana*, its cinematic and animated adaptations onto how the retelling in different version reveals the adaptability in different cultural contexts, emphasizing its timeless relevance.

Keywords: mythology, fiction, culture, adaptation, patriarchy, transformation, empowerment

Introduction

Adaptation is a dynamic process, influenced by social, economic, and cultural factors, and it enriches our understanding of human experience. The symbiotic relationship between mythology, cinematic adaptation, and literature forms an intricate tapestry of storytelling that transcends temporal and cultural boundaries. And mythology serves as a timeless reservoir of wisdom, offering insights into the human condition, values, and cultural identity. Across different cultures and epochs, myths continue to captivate and resonate with audiences, transcending boundaries of time and space. Through adaptation and reinterpretation, these age-old stories remain relevant, fostering a deeper understanding of ourselves and our place in the world. Literary adaptations of *The Ramayana*, an ancient Indian epic, offer insights into cultural values, moral teachings, and storytelling traditions. They reflect the enduring impact of the epic on diverse societies. Adaptations often highlight the universal themes of duty, righteousness, and the consequences of actions.

The Ramayana's rich diversity of versions and adaptations across cultures reflects its profound influence, from Valmiki's original Sanskrit rendition to diverse interpretations in various languages and artistic forms. In the 21st century, filmmakers have continued to push the boundaries of

mythological storytelling, blending elements of fantasy, adventure, and spectacle to create unforgettable cinematic experiences. The enduring connection between mythology, cinema, and literature is a testament to the power of storytelling to transcend time and space.

Research Objectives

The present research aims:

- To explore the portrayal of characters, how they have been empowered, starting from the adaptation of Ramanand Sagar to the contemporary age
- To study the how the retelling in different version reveals the adaptability in different cultural contexts, emphasizing its timeless relevance

Literature Review

Dibya (2023) explores of modern adaptations of Indian mythology across various mediums such as film, television, literature, and comic books reveals vibrant and evolving landscape rich with cultural significance and artistic innovation. Jalgaonkar (2023) argues that through adaptations in film and television, the ancient stories not only entertain but also offer profound insights into humanity's moral dilemmas and spiritual quests. Chakraborty (2022) states that the fusion of mythology and science fiction illuminates the timeless quest of humanity to comprehend the mysteries of existence. At its core, both mythology and science fiction are vehicles for human imagination and exploration. Zhuang (2022) explores diverse and innovative interpretations of the Ramayana worldwide. The article highlights the dynamic ways in which this epic narrative continues to inspire and captivate audiences across the globe, fostering a rich tapestry of interpretations that transcend geographical boundaries. Rahmoun (2020) showcases the dynamic interplay between literature and film adaptation, often referred to as screened literature, serves as a convergence point for esteemed literary works and the accessible realm of cinema. Vidyapeeth (2020) showcases how Devdutt Pattanaik's "Sita: An Illustrated Retelling of the Ramayana" stands as a remarkable and multifaceted exploration of the timeless epic. Rai (2018) argues that the symbiotic relationship between traditional folk culture and modern media forms like cinema, television, and advertisements is undeniable and increasingly acknowledged. Frog (2017) delves into the multifaced nature of myth, exploring it from various perspectives within folklore studies. He highlights the historical and ideological underpinnings of the term "myth," and emphasizes its role as both a storytelling mechanism and a model for understanding. Dhar

(2015) discusses the pervasive influence of the Ramayana in Indian culture and its global adaptations in films and popular media.

Research Gap

After growing through the literature review, we have found that the research so far has been focusing either on the portrayal of male characters, highlighting and focusing on the portrayal of male characters, focusing on their valour and fantasizing about their excellence. So, our project focuses on the portrayal of female characters, how they have been empowered date, starting from the adaptation of Ramanand Sagar to the contemporary age. Furthermore, then focusing on the current audience and the younger generation as they are fascinated about the sci-fi aspect of the adaptations and bringing together the mythological perspective, adding those to the adding those, along with the technical aspect through which the VFX and the other technicalities can be highlighted. We point toward identifying the gap between the 19th century and the 21st century adaptations.

Research Question

Q1. What are the various aspects that bring in transitions in retelling of The Ramayana, as a literary piece to the selected contemporary adapted and animated versions?

Research Methodology

The present work follows a structured research method of investigation. The initial steps involve reading *The Ramayana* English translation by Hari Prasad Shastri (1952), followed by watching and analyzing the cinematic adaptation of *The Ramayana Series* by Ramanand Sagar (1987), Om Raut (2022) and Nikhil Sinha (2015) and further concentrating at the animated version of The Ramayana by Yugo Sako gaining an understanding of their backgrounds and influences. The concepts of retelling, adaptability, cultural transition, and the transition in the portrayal of characters shall be highlighted and analyzed, exploring the similarities and differences in their depictions and perceptions of understanding by the readers and the audiences.

Analysis and Discussion

Hari Ram Prasad's *Ramayana* (1952)

Hari Ram Prasad's rendition of *The Ramayana* stands as a notable translation and adaptation of one of Hinduism's most revered epics. Originally composed in Sanskrit by the sage Valmiki, *The Ramayana* narrates the life of Lord Rama, an avatar of Vishnu, focusing on his quest to rescue his wife Sita from the demon king Ravana. This analysis explores Prasad's adaptation in terms of historical context, cultural impact, faithfulness to the original text, and several other aspects. While it adheres closely to the narrative structure and key themes of Valmiki's *Ramayana*, Prasad's translation is not merely a literal rendition; it is imbued with interpretative insights that make the epic more accessible and engaging to contemporary readers. Digital editions, audiobooks, and interactive online content have made the Ramayana more accessible than ever, ensuring its place in the digital age.

Ramayana by Ramanand Sagar (1987)

Ramanand Sagar's adaptation of *The Ramayana*, first broadcasted on Indian television in 1987, is a landmark series that not only captivated audiences across India but also made a profound cultural impact internationally. The series took considerable care to remain faithful to Valmiki's *Ramayana*, incorporating many of the epic's verses and episodes. However, Sagar also included elements from Tulsidas' *Ramcharitmanas* and other versions of *The Ramayana* to enhance emotional depth and devotional impact. Ramanand Sagar's *Ramayana* is a seminal work that not only depicted an ancient epic with reverence and creativity but also made a profound impact on Indian society and beyond. Its blend of storytelling, moral inquiry, and technological ingenuity has left an indelible mark, making it a cultural phenomenon with an enduring legacy.

Ramayana: The Legend of Prince Rama by Yugo Sako (1993)

In the animated epic "Ramayana: The Legend of Prince Rama," there are several powerful scenes that not only highlight the bravery and resilience of its characters. One of the most significant scenes occurs when Sita, the steadfast wife of Prince Rama, finds herself abducted by Ravana, the formidable demon king.



source:https://www.youtube.com/watch?v=gKcOjnDJfzk&t=995s&ab_channel=Ramayana%3ATheLegendOfPrinceRama

Despite the terrifying circumstances of her captivity, Sita demonstrates remarkable courage and resilience as she faces Ravana head-on. Refusing to succumb to fear or despair, Sita maintains her dignity and composure, standing firm in her principles and unwavering devotion to Rama.

Meanwhile, the character of Queen Kaikeyi adds layers of complexity to the narrative, offering a nuanced exploration of the human capacity for both folly and redemption. Overwhelmed by guilt and remorse, Kaikeyi seeks redemption for her past mistakes, demonstrating a willingness to acknowledge her faults and make amends.



source:https://www.youtube.com/watch?v=gKcOjnDJfzk&t=995s&ab_channel=Ramayana%3ATheLegendOfPrinceRama

The next scene from *Ramayana:* *The Legend of Prince Rama* offers a profound insight into the human condition, exploring themes of courage, redemption, and the enduring strength of the human spirit.

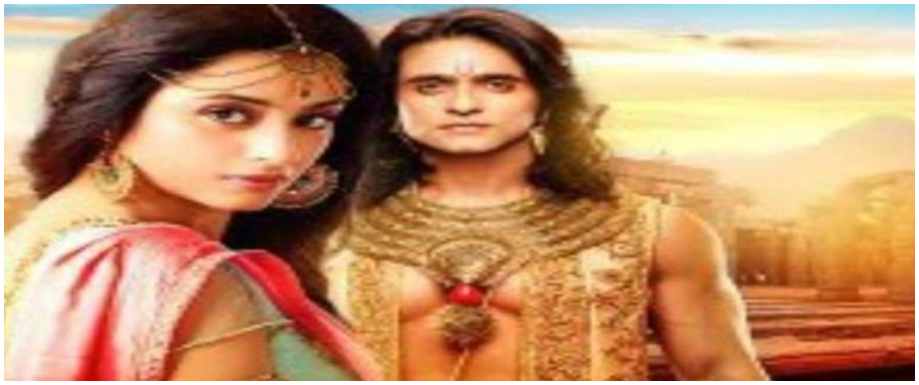


source:https://www.youtube.com/watch?v=gKcOjnDJfzk&t=995s&ab_channel=Ramayana%3ATheLegendOfPrinceRama

Through the journeys of characters like Sita and Kaikeyi, the film delivers powerful messages about the importance of staying true to one's principles, even in the face of adversity, and the transformative power of compassion, forgiveness, and self-reflection.

***Siya Ke Ram* By Nikhil Sinha Et.Al. (2015)**

The director in this adaptation gave more importance to Sita in *Siya Ke Ram* (of course the title itself shows) whereas original Ramayana focused on the real story of Rama. It showcases a parallel world while projecting the lives, birth and struggles as it highlights the childhood life of both Rama and Sita.



source: https://youtu.be/nXvcJyHBu0Y?si=jv8VdDAvpWu7Uzc8

Siya Ke Ram takes a more detailed approach to character development, exploring the childhoods of both Ram and Sita, providing viewers with additional context and insight into their upbringing and early experiences.



Source: https://youtu.be/WDdzAYZ2UDo?si=4XmKogFN8EjRVOeE

Further we also observe that Sita's character is projected as a warrior and she is well versed with the use bow and arrows. This series presents Sita as a character with considerable strength and agency, including portraying her as skilled in archery and other martial arts.



Source: https://youtu.be/538MsG3McnE?si=60h5MZL-BRzF-TbO

Siya Ke Ram indeed provided a more detailed and elaborate portrayal of certain events, including the death of Lakshman and Rama, as well as Sita's departure from the mortal world.



source: https://youtu.be/B_z6Kwjfpfo?si=r3TDQx7nrUJrXUXp

All these versions followed a more concise storytelling approach, focusing on the central narrative and key moral teachings without delving extensively into these specific events. These adaptations offer their own unique interpretations and contribute to the rich tapestry of the Ramayana retellings.

Conclusion

In conclusion, the myriad adaptations of the Ramayana, whether brought to life on the small screen like *Ramayana, Ramayana: The Legend of Prince Rama* and *Siya Ke Ram* or interpreted through visionary works like Hari Ram Prasad's rendition, Ramanand Sagar's monumental contribution Yugo Sako's artistic vision or Nikhil Sinha's ventures into new territory. It all stands as living proof of the timeless allure and universal relevance of this epic tale.

To conclude, each adaptation of *The Ramayana* is highly praised, which is not without its share of criticism and disagreement, especially regarding how characters and events are portrayed. Some people might argue that it doesn't stay true enough to the original story, or that it lacks deep insights. As we embark on this journey through the rich tapestry of mythological narratives, we discover not only the complexities of our past but also the limitless possibilities of our future, guided by the wisdom of gods, heroes, and moral lessons that echo through the ages.

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National Rural Livelihood Mission (NRLM) on Sustainable Livelihood on Climate- Resilient Agriculture

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Abstract

From ancient time, human civilization has been facing a lot of constraints and challenges in its sustainable developmental phase among which poverty seems to be the most disastrous one. India, as a second largest democratic country in the world, is also facing such problem which seems to be one of the vital barriers for inclusive growth as well as to compete with other developed and developing countries in several dimensions. Unfortunately, even after seventy years of independence, a large percentage of Indian population belonging under Below Poverty Line (BPL) category. In this context, different research studies evident that the rural India is suffering a lot which is supposed to be more severe than that of the urban areas of India. Therefore, special attention is to be assured to eradicate poverty through which livelihood of general populace can be developed and in this context, rural poor should especially be addressed. Respecting this issue and welcoming inclusive growth for socioeconomic excluded poor people mainly from rural boundary, different developing and underdeveloped countries time-to-time declared various promotional and developmental programmes. In this context, National Rural Livelihood Mission (NRLM), implemented by the Central Government of India has become the World's largest poverty alleviation scheme. Hence, it is very essential to visualize the practical application and acceptance of the welfare prospect of the very Mission in rural vulnerable populace. This effort can be materialized successfully with the measurement of the sustainable livelihood promotion as introduced by the said scheme for the marginalized rural poor attached with a socioeconomic backward area.

In the present paper, an attempt has been framed to enumerate the literature on the issues like poverty, livelihood promotion of vulnerable sections of society, different promotional schemes including National Rural Livelihood Mission and their roles in promoting the said sections towards sustainable livelihood promotion.

Keywords: Economic Empowerment, Inclusive Growth.

Introduction

The National Rural Livelihoods Mission (NRLM), now renamed as Deendayal Antyodaya Yojana-National Rural Livelihoods Mission (DAY-NRLM), was launched on 3rd June, 2011. The Mission has a mandate to reach out to 8-10 crore rural poor households in 2.5 lakh Gram Panchayat across the country and link them to sustainable livelihood opportunities and nurture them till they come out of poverty. NRLM believes that poor have innate capabilities to graduate out of poverty. The challenge is to unleash these entrepreneurial capabilities by complementing them with capacities (knowledge, information, tools, collectivization and finance). Mobilization of rural poor women into Self Help Groups (SHGs) and their federation is the modus operandi of NRLM. SHGs are homogenous groups of 5-20 women which function on the principles of mutual cooperation and collective action. These SHGs are federated at the village/Gram Panchayat, cluster and block levels. The institutions provide services (savings, credit, livelihood support) to their members that help them strengthen and sustain their livelihoods. As the SHGs and their federations mature, they create a strong demand system on behalf of members. These institutions of poor are designed to create their own human, social, financial resources. Linkages with mainstream institutions such as banks, local governance bodies, and government bodies help them address different dimensions of poverty. These measures enable members to improve their access to entitlements, rights, resources and livelihood opportunities.





Key Components

Promoting Institutions of Poor: Strong quality institutions of poor such as SHGs and their federations are set up on priority basis. In addition to generic thrift and credit-based community institutions and their federations, DAY-NRLM promotes specialized institutions like livelihood collectives, producers' cooperatives/companies for livelihoods promotions through economics of scale, backward and forward linkages.

Training, Capacity Building and Skill Building: A multi-pronged approach has been adopted for providing continuous capacity building to the targeted families, SHGs, their federations, government functionaries, bankers, NGOs and other stakeholders.

Vulnerability Reduction Fund (VRF) and Community Investment Support Fund (CIF): Vulnerability Reduction Fund (VRF) and Community Investment Support Fund (CIF) is routed to SHGs through federations (primary and secondary level) to support livelihoods of members and initiate collective activities for the members.

Mahila Kisan Sashaktikaran Pariyojana (MKSP) launched in 2010-11, is a special scheme for livelihood enhancement under DAY-NRLM. It is a concerted effort to recognize the role of women in agriculture. Investment is made to enhance their capacities, increase their income, and encourage participation in agriculture and allied activities.

Their integration into the community also ensures their commitment and long term availability to serve the community sustainably. BC Sakhis, as

members of SHGs themselves, serve the whole community but especially SHGs, their member and other women as well as those households who did not have access to financial services before. They are therefore able to overcome social and cultural (caste) barriers in the communities. BC Sakhis have been instrumental in reaching to last mile of the community to provide basic banking services.

The key interventions in the non-farm livelihoods sector comprise programmatic interventions through the Start-up Village Entrepreneurship Programme (SVEP), Aajeevika Grameen Express Yojana (AGEY) and other specific cluster-based interventions in states. During 2019-20, the focus was on starting the enterprise formation in blocks in which projects were approved in different phases under SVEP in the previous years, and supporting the implementation of the AGEY with the objective of meeting the demand for rural transportation.



Current Status

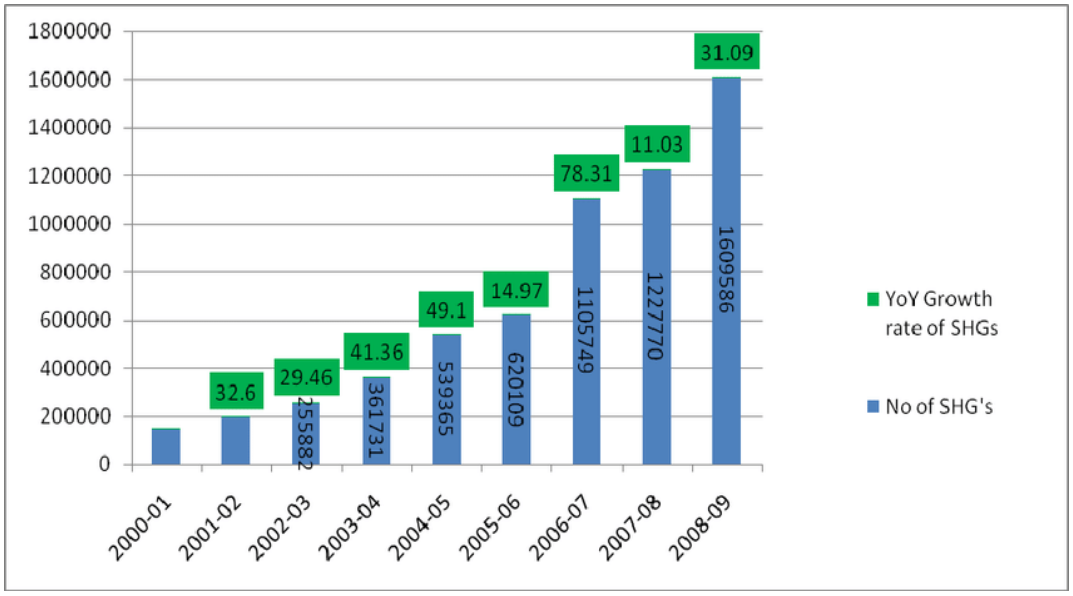
"DIDI KI BUNAI - Transforming lives of rural women in Haryana." Didi ki Bunai has inspired rural women to take up similar projects under SVEP. Didi ki Rasoi – A community kitchen for the local workforce has already started. These two projects in the Pinjore block are sustainable and scalable. It is interesting to note that the majority of entrepreneurs are women and are members of SHGs. All CRPs are women and an inclusive approach would add value to it. Moreover, Non-SHG members should not face any problems in getting the benefits of the SVEP. The SVEP is all set to transform the lives of rural people and women entrepreneurs have shown their capabilities to lead.

In India, women constitute 48.2 per cent of the total population, 44.62 per cent of the total agricultural labourers and their economic contribution in the family is 44 per cent according to 2001 census. Economic empowerment means mobilization of self help efforts to raise the income and standard of living. Economic empowerment can be observed at household, community and broader area level, through control over income and relative contribution to family support. At broader area level women are said to be empowered on the basis of women's representation of economic interests in macro-economic policies. The policies and programmes implemented by Ministry of Rural Development through NRLM pave the way to economic empowerment. As women need access to better business climate to support them in financial sector, the National Rural Livelihood Mission (NRLM) laid emphasis on investment credit needs with the objective to reduce poverty by enabling the poor to access self-employment opportunities through building strong grass root institutions. The present paper deals with how NRLM scheme enables the economic empowerment of women, into the formal financial sector.

Review of Developments and Way Forward

The progress of SHGs in last two decades has been remarkable, thus, becoming an inseparable part of the developmental infrastructure, embodying massive social capital of social mobilization and empowerment of women. With the rapid spread of SHGs over time, the innovations associated with them have also flourished. Essentially, Self Help Groups (SHGs), everywhere, act as tiny savings and loan cooperatives providing economic means to poor people to engage in productive activities and inculcation of saving habits. The success of SHGs has attracted widespread attention of policy makers for attaining multiple objectives like poverty reduction, women empowerment, social upliftment, financial inclusion, entrepreneurial development, reducing inequality, etc.

The reason for the success of this programme was the role of SHGs in financial inclusion/ mainstreaming of poor families as well as a development model with wider application. It is interesting to look back at the SBLP in 1992-93 when only 255 SHGs were financed.



The livelihood promotional schemes as introduced to alleviate poverty and thus to promote poor individual from different aspects have received considerable attention and interest from several researchers of national and international levels. Therefore, an attempt has been framed to locate the related issues – poverty, livelihood promotion of vulnerable sections of society and different promotional schemes, their roles to promote the said sections and estimation of sustainable livelihood promotion.

Areas of Improvement

- **Poverty and Inequality:** Widespread poverty persists, characterized by low income, limited access to basic services, and unequal distribution of resources. Income inequality between rural and urban areas and within rural regions hampers equitable development**.**

- **Agricultural Distress**: Dependence on agriculture as a primary livelihood exposes rural communities to risks posed by unpredictable weather patterns, market fluctuations, and crop failures. Fragmented land holdings, inadequate irrigation, and outdated farming practices hinder productivity and income generation.

- Unemployment and Underemployment Inadequate non-farm employment opportunities lead to seasonal unemployment and underemployment in the agricultural sector .Lack of skill development and market-oriented vocational training limits rural workforce engagement in diverse sectors.

- **Infrastructural Gaps:** Insufficient rural connectivity, including roads, electricity, and telecommunication, limits access to markets, services, and

information. Basic amenities such as clean drinking water, sanitation facilities, and healthcare remain inadequate in many rural areas.

- **Climate Change and Biodiversity Loss:** Rural areas are impacted by the effects of climate change, such as droughts, floods, heat waves, and extreme weather events. These can affect the availability and quality of natural resources, such as water, soil, and forests, and the livelihoods of rural communities, especially farmers and pastoralists. For example, the population of farmland birds declined by one-third between 1990 and 2016.

- **Migration and Urbanisation:** Rural areas are experiencing a high rate of out-migration, especially of young and educated people, to urban and semi-urban areas in search of better opportunities and services. This can result in labour shortages, land fragmentation, social isolation, and loss of cultural identity in rural areas. On the other hand, urbanization can also bring some benefits to rural areas, such as improved connectivity, market access, remittances, and innovation.

- Addiction and Mental Health Rural areas are facing a rise in addiction to tobacco, gutka, liquor, and social media among rural youth and adults. These can have negative impacts on the health, productivity, social relations, and safety of rural people. Moreover, rural areas often lack adequate mental health services and awareness, which can lead to stress, depression, suicide, and violence.

- **Waste Management and Sanitation:** Rural areas often lack proper waste management systems and facilities, such as segregation at source, composting/biogas plants/recycling units for organic/inorganic waste respectively. This can lead to environmental pollution, health hazards, aesthetic degradation, and loss of resources. Rural areas still face challenges in achieving universal access to sanitation facilities and hygiene practices.

Conclusion

The SHG movement has connected millions of poor women to the banking services and more importantly created healthy financial habits like savings, inter-lending, loaning and poverty reduction. However, the states in the Northern part of India, especially Haryana, seem to have remained untouched with this movement. The paper reveals the multifarious reasons which explains the failure of SHG movement in Haryana viz., lack of social cooperation, individualistic tendencies, concentration on dairying at the cost of group

activity, patriarchal nature of society, discrimination of women reflected in adverse sex ratio, caste differences, faulty implementation of programmes, lack of appropriate trainings, stagnant saving mobilization, non-cooperation of banks, lack of financial knowledge, inadequate grievance redressal forums, lack of entrepreneurial experience, lack of political initiative, etc., which have led to failure of SHG movement in the northern region.

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Review Study of Education in Sustainable Development

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Abstract

This comprehensive review examines the intricate interplay between education and sustainable development, shedding light on the myriad ways in which education serves as a driving force for promoting sustainable practices and attitudes. Through an extensive analysis of diverse scholarly works, this study delves into the manifold impacts of education across various educational levels and settings, elucidating its role in fostering ecological literacy, social equity, civic responsibility, and environmental stewardship. Furthermore, the review underscores the indispensable role of educators and educational institutions in creating conducive learning environments and nurturing a culture of sustainability. The progress achieved in integrating sustainability into educational frameworks, the review also identifies persisting challenges, such as resource constraints and the imperative for pedagogical transformation. The key findings for future research, this review offers valuable insights for advancing the integration of sustainability into education and addressing global sustainability challenges effectively.

Introduction

In recent decades, the integration of sustainable development principles into educational frameworks has garnered increasing attention across various scales, from local to international arenas. From formal educational settings to informal learning environments, initiatives aimed at infusing sustainability concepts into curricula have proliferated, reflecting a growing acknowledgment of the urgency to cultivate a generation of informed and empowered global citizens. This review seeks to explore the multifaceted terrain of education for sustainable development (ESD), examining both its theoretical underpinnings and practical applications within diverse contexts. By synthesizing existing research contributions, our objective is to elucidate key themes, emerging trends, and persistent challenges shaping the discourse on ESD.

Through this review, we aspire to contribute to ongoing conversations the role of education in promoting sustainable development. By critically engaging with existing literature, aim is to inform future research trajectories,

policy formulations, and pedagogical innovations aimed at fostering a more equitable, just, and sustainable global landscape.

Factors Affecting Review Study of Education on Sustainable Development

Numerous factors can influence the examination of education's impact on sustainable development.

- **Policy Landscape:** The presence of supportive policies and frameworks at both national and international levels significantly shapes the focus and trajectory of sustainable development education. It's crucial for the review to analyze how educational policies align with sustainability goals.

- **Curriculum Formation:** Integrating sustainable development concepts and themes into educational curricula is vital. The review should gauge the extent to which sustainability-related subjects are woven into various academic disciplines across different educational tiers.

- **Educator Training and Capability:** The proficiency and comprehension of educators regarding sustainable development profoundly affect the efficacy of educational efforts in this domain.

- **Engagement of Stakeholders:** Involving diverse stakeholders such as students, parents, community members, and non-governmental organizations is pivotal for advancing sustainable development education. The review needs to assess the level of stakeholder involvement in shaping education policies and practices.

What Does Education for Sustainable Development offer in Initial Teacher Training? A Systematic Review - M. C. Pegalajar-Palomino Antonio Burgos García Estefanía Martínez Valdivia Education, Environmental Science Journal of Teacher Education for Sustainability

1 June 2021

Promoting Education for Sustainable Development (ESD) within higher education signifies an enhancement of responsible citizenship and quality, with future educators positioned as pivotal figures in fostering societal sustainability. This research aims to examine and consolidate scientific insights regarding the attitudes, skills, and preparatory efforts of prospective educators concerning ESD. Utilizing a qualitative approach, a thorough

examination of prominent scholarly repositories such as WoS and Scopus has been conducted.

Its objective is to gather and analyze scientific evidence regarding future educators' perspectives, competencies, and readiness for ESD. Through a systematic review, the research reveals a significant finding—prospective educators demonstrate positive attitudes towards sustainability and show dedication to environmental causes.

J. Lohmann J. Breithecker Ulrike Ohl Petra Giess Stüber H. P. Brandl-Bredenbeck Education, Environmental Science Sustainability
2 December 2021

To effectively implement education for sustainable development (ESD), it's crucial that teachers across all subjects, including physical education (PE) teachers, are equipped with specific professional competencies tailored to ESD. This study aims to contribute theoretically by clarifying the key concepts of ESD-specific teacher competencies, particularly in relation to PE. In summary, this systematic review contributes to understanding ESD-specific teacher competencies, particularly within the context of physical education. It underscores the importance of further exploring and integrating motivational orientation, self-regulation, and subject-specific considerations in developing teacher competencies for effective ESD implementation.

Mapping a Sustainable Future through Conceptualization of Transformative Learning Framework, Education for Sustainable Development, Critical Reflection, and Responsible Citizenship: An Exploration of Ashraf Alam education, Environmental Science ECS Transactions 24 April 2022

The research delves into the conceptualization and implementation of transformative learning in education for sustainable development (ESD) and sustainability learning, aiming to gather evidence on fostering transformative learning in both formal and non-formal educational settings.

Additionally, the importance of education for sustainable development (ESD) in academia and its integration into educational systems is emphasized. Studies such as Dautremont-Smith (2017) and Lozano et al. (2015) highlight the significance of sustainability in higher education, while Molokova (2021) explores the role of higher education in sustainable development and regional disparities in education accessibility. Pauw et al. (2015) discuss the effectiveness of ESD and the UN Decade of Education for Sustainable Development overseen by UNESCO to enhance its impact.

Title: The Impact of Development Education and Education for Sustainable Development Interventions: A Synthesis of the Research

These papers cover various themes, including ESD, GCE, and intercultural education. The paper provides an overview of assessment measures employed, evaluates evidence of impact on learners, and discusses methodological and pedagogical considerations arising from the review.

Development education, ESD, and GCE play crucial roles in nurturing informed and engaged global citizens capable of addressing pressing global challenges. The Sustainable Development Goals stress the importance of integrating these educational approaches into formal and informal learning environments.

A systematic review methodology was employed to identify relevant studies from prominent databases. Inclusion criteria were established to ensure the selection of papers focusing on intentional educational interventions addressing global justice and sustainability issues. Data extraction and analysis were conducted to identify common themes, assessment measures, and reported impacts on learners.

Title: Transitioning from Environmental Education to Education for Sustainable Development in Higher Education: A Review of the Literature

Environmental education (EE) and education for sustainable development (ESD) represent two significant currents in the realm of education concerning environmental issues. While EE initially focused on environmental protection, ESD signifies a formal commitment endorsed by the United Nations to ensure sustainable development. This review paper evaluates the effectiveness and acceptance of the transition from EE to ESD, particularly within higher education institutions. A systematic review methodology was employed to identify and analyze pertinent literature from databases such as Scopus, Science Direct, ERIC, and Sicelo. In total, 198 papers meeting predetermined inclusion criteria were selected for analysis.

Title: A Comparative Analysis of Education for Sustainable

Development: A Bibliometric Review and Systematic Review Perspective

This paper presents a comparative analysis of Education for Sustainable Development (ESD) through two methodological lenses: a bibliometric review and a systematic review. The bibliometric review by Grosseck, Țîru, and Bran (2019) analyzes 1813 papers indexed by the Web of Science from 1992 to 2018, while the systematic review by Acosta Castellanos and Queiruga-Dios (2022) evaluates 198 papers indexed in Scopus, Science Direct, ERIC, and Scielo. With growing interest in Education for Sustainable Development (ESD), assessing the field's evolution and challenges is crucial. This paper compares two seminal studies: Grosseck et al.'s bibliometric review and Acosta Castellanos and Queiruga-Dios's systematic review.

An in-depth literature review of the evolving roles and contributions of universities to education for sustainable development.

Benjamin Karatzoglou

Journal of Cleaner Production 49, 44-53, 2013

For over twenty years, universities have consistently been recognized as significant players in advancing regional sustainability initiatives. The multifaceted nature of sustainable development (SD) has positioned universities as crucial partners in collaborative endeavours alongside other local stakeholders.

Sustainability in Higher Education and the Journal of Cleaner Production. The findings reveal a diverse array of ESD research spanning different regions, topics, methodologies, and outcomes. Notably, prevalent methodological approaches encompass both theoretical explorations and case studies.

Education for sustainable development: Evolution and perspectives: A bibliometric review of research, 1992–2018

Gabriela Grosseck, Laurențiu Gabriel Țîru, Ramona Alice Bran
Sustainability 11 (21), 6136, 2019

In recent years, there has been a notable surge in research interest surrounding Education for Sustainable Development (ESD). Therefore, a comprehensive reevaluation of this field and its associated challenges is

imperative to gain deeper insights into the diverse approaches to ESD and how scholars, countries, institutions, or universities have responded through research and scientific publications. This collaborative nature of publishing on ESD reflects international endeavors to elevate this area of inquiry into the mainstream discourse.

Title: Evolution of Universities' Roles in Education for Sustainable

Development: A Comprehensive Review of Literature

This paper presents a comprehensive review of the evolving roles and contributions of universities to education for sustainable development (ESD) from 2003 to 2018. It synthesizes findings from two key articles published in the Journal of Cleaner Production (2013) and Sustainability (2019), along with additional relevant. The paper underscores the significance of universities as critical partners in regional sustainability initiatives and discusses the challenges and opportunities in integrating sustainable development principles into education. Overall, this research provides valuable insights into the evolution and perspectives of universities' roles in ESD, contributing to the advancement of knowledge in this crucial area.

Objective of Review Study of Education on Sustainable Development

- To raise awareness about social, economic and environmental issues.
- To foster values and attitudes such as empathy, responsibility and respect for diversity.
- To build knowledge and skills.
- To promote critical thinking towards viable practices in sustainable development.

Conclusion

In summary, education for sustainable development (ESD) emerges as a fundamental component in our shared endeavors to confront the intricate challenges confronting our planet and societies. Through this educational paradigm, we are presented with the opportunity to furnish present and future generations with the requisite knowledge, aptitudes, values, and outlooks to forge a more sustainable and fairer world.

Moreover, ESD holds promise in championing inclusive and equitable sustainable development by ensuring fair access to quality education for all learners, irrespective of their backgrounds or circumstances. By advocating for

continual learning and ongoing engagement in sustainable development endeavors, ESD enables individuals to adapt to evolving contexts and contribute meaningfully to fostering resilient and sustainable societies.

In conclusion, education for sustainable development transcends being a mere choice; it is a vital imperative in our pursuit of a more sustainable future. As we advance, it is imperative that we persist in investing in and prioritizing ESD initiatives, acknowledging their capacity for transformative impact in shaping a world that is equitable, inclusive, and environmentally sustainable for generations to come.

Limitations

- Inability to gather sufficient funding for sustainable development programs.
- Resourcing outdated or inadequate curriculum and knowledge that does not adequately cover sustainability topics in the current time.
- Insufficiency of trained educators with expertise in sustainable development.
- Facing socio-economic barriers, such as unequal access to education based on social status or geographic location.

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Impact of Family Migration on Elderly People

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Abstract

The present study is an attempt to examine the consequences of family migration on elderly people in India. The study is based on secondary sources and try to highlights various issues and problems which the elderly people are facing with in the family. Family migration played a significant role for socio-economic upliftment, but on the other hand it creates lot of problems for the elderly members in the family.

Keywords: *Family, elderly people, migration, issues and challenges.*

Introduction

Family migration is a considerable phenomenon globally, with profound implications for numerous components of individuals' lives, specifically for older adults. As societies go through demographic shifts and financial modifications, knowledge the effect of family migration on elderly human beings has turn out to be increasingly more critical. This studies task targets to discover and analyse the multifaceted effects of own family migration on the properly-being, health, and social dynamics of older mother and father.

The have a look at attracts upon insights from numerous seminal studies papers that have investigated the consequences of own family migration on older adults in different cultural and geographical contexts. Rachel Connelly and Zhenzhen Zheng (2012) examined the effect of family migration on older mother and father in rural China, shedding light at the financial and social dynamics inside household's present process migration. Fei Guo and Zai Liang (2014) contributed to this expertise by exploring the monetary and social effects of migration for the aged in rural China, emphasizing the complexities of intergenerational relationships and assist networks.

Bijou Rojo and Anna Tomassini (2017) extended this research to Kerala, India, investigating the relationship between own family migration and elderly health. Anne R. Pebley and Emily A. Schuler (2019) stated that the geographical scope to Mexico, analysing the impact of own family migration on fitness and healthcare usage among older adults. Their findings underscored the

significance of thinking about socio-cultural elements and healthcare get admission to in understanding the health implications of family migration.

Additionally, Ruth Lowndes, Rachel Hurdley, and HanaaSadiq (2020) conducted a qualitative take a look at on transnational households, migration, and the nicely-being of older human beings, presenting insights into the emotional and social dimensions of circle of relative's migration studies. By synthesising findings from this various research, this research project goals to make a contribution to a complete expertise of the complicated dynamics surrounding circle of relative's migration and its implications for the properly-being of older adults throughout extraordinary cultural contexts.

Through empirical studies and qualitative analysis, this observe seeks to clarify the demanding situations and possibilities associated with circle of relatives migration for aged people, with implications for coverage interventions, social support systems, and future studies agendas. By shedding light in this understudied issue of migration dynamics, these studies objectives to inform strategies aimed toward selling the health, well-being, and social inclusion of older adults in migrant households.

Literature Review

Migration is a global phenomenon with tremendous implications for individuals, households, and societies. In latest decades, there has been growing hobby in know-how the impact of family migration on elderly individuals, especially in rural and developing contexts. This literature evaluation synthesises findings from numerous key studies to explore the economic, social, and fitness outcomes of circle of relative's migration on older parents.

Connelly and Zheng (2012), which explores the reports of elderly dad and mom left in the back of by way of migrating adult kids in rural China, we benefit treasured insights into the financial, social, and psychological impact of own family migration on older parents. Through qualitative interviews and survey facts analysis, the authors highlight the dual nature of migration, in which it ends in expanded monetary support for elderly dad and mom however also outcomes in social isolation and a lack of care, impacting their ordinary properly-being.

Building in this, Guo and Liang (2014) reported that the economic and social consequences of migration on elderly people in rural China. Utilising quantitative analysis of survey records, they have a look at modifications in profits, family composition, and social aid networks among aged migrants and non-migrants. Their findings underscore the importance of social support

networks and community sources in mitigating the bad effects of family migration on the well-being of older adults.

Shifting the geographical recognition to Kerala, India, Rojo and Tomassini (2017) explore the relationship between own family migration and the fitness effects of aged individuals. Through a blended-methods technique combining survey statistics and qualitative interviews, they find the bodily and mental fitness implications of migration for elderly migrants and non-migrants. Their examine highlights the nuanced outcomes of migration on aged health, inspired by way of factors inclusive of get entry to healthcare services and social help.

Pebley and Schuler (2019) look at the effect of own family migration at the fitness and healthcare utilisation of older adults in Mexico. Through quantitative analysis of survey facts, they observe variations in health outcomes and healthcare get entry to among elderly migrants and non-migrants. Their findings monitor both high quality and terrible health outcomes related to migration, with socio-financial popularity and get entry to to healthcare services gambling a extensive function.

Hurdley, and Sadiq (2020) behaviour a qualitative take a look at on transnational families and the properly-being of older people, imparting insights into the lived studies and feelings of elderly people stricken by migration. Through in-depth interviews and cognisance group discussions, they explore the social, cultural, and psychological dimensions of migration for aged migrants and their families. Their observe emphasizes the importance of thinking about social connectedness and cultural identification in understanding the effect of migration on aged nicely-being.

Research Methodology

The present study is based on secondary, such as book, journal, government report, articles and online sources. The study examines the various issues and problems which the elderly people are facing after family migration.

Finding of the Study

- **Impact on Elderly Well-being:** Family migration can notably impact the properly-being of aged individuals, each positively and negatively, relying on different factors which include social help networks, get entry to healthcare, and economic assets.

- **Economic Consequences:** The migration of younger circle of relatives members often end in changes inside the economic situations of aged dad and mom, with a few experiencing economic stress due to reduced assist or reliance on remittances from migrant own family contributors.

- **Social Isolation:** Family migration can increase the chance of social isolation among elderly individuals, mainly in rural areas where conventional assist structures are disrupted, leading to emotions of loneliness and reduced social engagement.

- **Healthcare Access:** Elderly individuals stricken by family migration may additionally face challenges in getting access to healthcare offerings, consisting of physical and intellectual fitness care, because of factors which include mobility obstacles, monetary constraints, and shortage of familial guide.

- **Mental Health Impact:** The separation from circle of relatives participants due to migration will have poor results on the intellectual fitness of older adults, contributing to emotions of depression, tension, and loss.

- **Coping Strategies:** Older adults often employ various coping strategies to mitigate the challenges related to family migration, consisting of counting on social networks, carrying out network sports, and in search of guide from spiritual or cultural institutions.

- **Inter-generational Relationships:** Family migration can impact inter-generational relationships, with modifications in conversation patterns, caregiving obligations, and emotional dynamics between aged parents and migrant children.

- **Gender Dynamics:** Gender performs a substantial role in how family migration impacts elderly individuals, with women frequently bearing the brunt of caregiving obligations and experiencing extra social isolation and monetary vulnerability.

- **Policy Implications:** There is a want for regulations and packages that address the unique needs of aged people stricken by circle of relative's migration, along with social support initiatives, healthcare reforms, and monetary empowerment strategies.

- **Transnational Families:** The phenomenon of transnational households, where participants are geographically dispersed throughout borders,

provides precise demanding situations and opportunities for the nicely-being of older adults, highlighting the importance of preserving familial connections and fostering resilience throughout distances.

- **Diverse Geographical Contexts:** The studies cowl a range of geographical contexts, consisting of rural China, Kerala in India, Mexico, and transnational households. This range highlights the worldwide significance of the issue and indicates that the effect of family migration on aged humans is not restrained to unique regions however is a large phenomenon.

- **Economic and Social Consequences:** The studies initiatives look at both the economic and social effects of circle of relative's migration on aged people. This holistic technique recognizes that migration can affect diverse components of older adults' lives, inclusive of their financial safety, social aid networks, and ordinary well-being.

- **Health Implications:** Several research, inclusive of those carried out in Kerala, India, and Mexico, explore the health implications of family migration on older adults. This commentary indicates that migration may have each effective and bad effects on aged individuals' health, depending on elements which include get right of entry to to healthcare offerings and social help structures.

- **Policy Implications:** By inspecting the impact of own family migration on elderly humans, those research projects make a contribution to the development of evidence-primarily based guidelines and interventions aimed toward assisting older adults in migrant households. Understanding the demanding situations confronted by means of aged people can tell coverage decisions associated with healthcare, social welfare, and migration governance.

Conclusion

The literature overview contributes to our understanding of the complicated dynamics of own family migration and its effect on aged human beings. By synthesising existing research and identifying key tendencies and research gaps, this overview provides valuable insights for researchers, policymakers, and practitioners working inside the fields of migration, getting old and social welfare. Understanding the experiences and needs of aged migrants is important for developing proof-based totally regulations and interventions that guide their nicely-being and sell social inclusion.

Significance of the Study

The importance of reading the effect of circle of relative's migration on aged humans can't be overstated, because it offers precious insights into the complex social, financial, and health implications for this vulnerable demographic institution. Drawing insights from a couple of studies papers, several key insights emerge, every losing light on distinctive elements of the phenomenon. Firstly, information social support networks are important, because it allows discover ability resources of social isolation and loneliness the various aged while family participants pass away. This knowledge is essential for developing interventions aimed toward fostering social connectedness and decreasing the negative effect of migration on elderly properly-being. Secondly, investigating how own family migration affects healthcare get admission to and usage among older adults is crucial for figuring out capacity limitations they will face in having access to important clinical services. This understanding can inform rules and interventions aimed at improving healthcare equity for aged migrants and making sure they get hold of the care they need. Additionally, analysing the monetary outcomes of circle of relative's migration on older parents gives insights into how their financial balance can be affected whilst person children move away. Understanding those dynamics can inform social welfare regulations and packages designed to support elderly people, in particular in rural regions wherein sources may be limited. Moreover, inspecting the mental well-being of older adults in the context of owns family migration enables us apprehend the emotional impact of separation from loved ones. This understanding is important for developing interventions aimed toward selling mental fitness and resilience among aged migrants, thereby improving their average nicely-being. Furthermore, investigating the experiences of transnational families offers insights into the complexities of retaining relationships across borders. Understanding how own family migration shapes intergenerational relationships and caregiving arrangements can inform rules and applications geared toward assisting transnational families and selling familial bonds. Additionally, exploring how own family migration impacts cultural adaptation and integration amongst older adults highlights the demanding situations and opportunities they'll come across in adjusting to new social environments. This know-how can tell culturally sensitive interventions and guide offerings for aged migrants, ensuring they get hold of suitable help as they navigate cultural transitions. Moreover, drawing on studies from more than one disciplines, consisting of sociology, demography, and public fitness, lets in for a complete expertise of the multifaceted effect of circle of relatives' migration on elderly individuals. This interdisciplinary method is critical for addressing the complicated social, financial, and health-related implications of migration on growing old populations. Furthermore, synthesising findings from research at the impact of own family migration on older adults informs the

development of proof-based totally regulations and interventions aimed toward addressing the desires of elderly migrants. This can help make certain that regulations are attentive to the particular challenges faced through this populace and promote their well-being and social inclusion. Additionally, comparing findings from research carried out in different areas permits for a nuanced information of ways contextual factors form the effect of own family migration on elderly individuals. This comparative analysis enables identify not unusual styles in addition to area-precise dynamics that influence the studies of aged migrants. Lastly, longitudinal research tracking the studies of aged individuals and their families through the years offer precious insights into the long-time period results of own family migration on growing old populations. Understanding how these dynamics spread over the lifestyles direction can inform anticipatory policies and interventions aimed at assisting elderly migrants at exclusive degrees of their migration adventure. Overall, analysing the impact of family migration on aged human beings is vital for informing rules and interventions aimed toward supporting the well-being of this populace. By understanding the social, economic, and fitness implications of migration, policymakers and practitioners can develop strategies to address the needs of aged mother and father tormented by circle of relative's migration.

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Scope and Impact of Self-Help Groups

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Abstract

A group of individuals with similar socioeconomic backgrounds who have a desire to work together towards a common goal. In SHGS, people come together informally to address common problems. Even though self-help might seem to focus on the individual, one of the most important characteristics of self-help groups is mutual support. The success made by these groups is in making Indian rural women self-reliant. Thus, with the help of SHGs, the rural poor become economically upgraded, and need not to Self-Help Groups (SHGs) are informal associations of people who choose to come together to find ways to improve their living conditions. It can be defined as a self-governed, peer-controlled information group of people with similar socio-economic background and having a desire to collectively perform common purpose. One of the reasons for rural poverty in our country is low access to credit and financial services. In India, self-help groups (SHGs) are a type of microfinance program designed to end poverty by empowering women. Through a scheme called "bank-linkage," the government can assist low-income women in improving their socioeconomic status by providing them with easy access to the financial system. India is not developed because women's advancement is not commensurate with that of men's. Self-help groups are being promoted by India as a platform to address the issues that support women's empowerment and development.

Keywords: self-help groups, empowerment, socio-economic, political schemes, poverty

Introduction

In the self-help group (SHG) conceptual framework, empowerment, group action, and community development are fundamental concepts. By encouraging self-reliance, brotherhood, and support among members, SHGs offer a grassroots solution to socioeconomic problems. Fundamentally, the SHG model highlights the significance of inclusiveness, bottom-up development approaches, and participatory decision-making. Poor individuals organize into small groups of people called Self Help Groups, or SHGs. Individuals within a Self-Help Group face difficulties and challenges. They help one another in

resolving issues. Small savings are encouraged among members of SHGs. The bank holds the savings. This is the SHG's common fund. The Self-Help Group provides its members with small loans from its common fund. In urban locations, upper class families are better able to see the progress. Recently, there has been worry about women who are entrepreneurs. This research paper discusses women and youth entrepreneurs, their status, and the difficulties, problems, and difficulties they experienced when they tried to create a place for themselves in the fiercely competitive world of business. Self-help initiatives, a government flagship program, are the primary goal of the programs, which are being implemented in all states, is to support unemployed young people and groups in order to expand access to financing for the growth of rural and urban organizations.

Objective of the Study

- To comprehend the fundamental goal of SHGs
- To comprehend how SHGs operate.

Methodology

A comprehensive analysis of the literature review has been used to analyze the scope and complexity of self-help groups as a platform for aspiring business owners. The conclusions were supported by an analysis of academic journals, magazines, books, reports, papers, and dissertations.

Review of Literature

According to Haridas (2013), the main focus of their research was "SHGs and Their Business Issues." He argued in favour of supporting programs that enable self-help groups (SHGs) to effectively empower women, who comprise about half of the nation's population. The government has endeavoured to provide education and training to women affiliated with different self-groups by means of poverty reduction programs including the Development of Women and Children in Rural Areas (DWCRA), the Training of Rural Youth for Self-employment (TRYSEM), and the Integrated Rural Development Programme (IRDP). SHG members had to deal with a variety of challenges when operating their firms, including determining the size of their target market and developing workable product concepts.

Narasimhan (2012) has written in further detail about the current status of Tamil Nadu's efforts to provide SHGs with an emblem, name, and other distinguishing characteristics in order to assist them in building a market for

their goods and a reputation for themselves. Because the government established marketing organizations at the block and district levels, SHGs now have a distribution network and supply chain. Due to the extensive support network and robust delivery system that marketing organizations provide, these SHGs are able to sell their goods across the entire state and even the nation. The analysis of how self-help organizations in India use social media is conspicuously lacking. Social media is a powerful argument for its inclusion in the research because of its widespread impact on all facets of contemporary life, including SHGs.

Shylendra (2013) with an emphasis on the Self-Help Group (SHG)-Bank Linkage Programme (SBLP) in India, we attempted to identify and talk about some of the important conceptual and policy questions as well as new insights from cooperatives' embrace of microfinance. The study validates that cooperatives encounter noteworthy obstacles in accomplishing the two intended consequences of the association, specifically environmental sustainability and social inclusion. While there was some excellent work done by the cooperatives, overall, the linkage did not live up to expectations. A few of the factors that have been identified as impacting performance are the inherent limitations of microfinance as well as the organizational and legal restrictions placed on unions while implementing microfinance. The article has shed light on how the long-standing problem of privileged capture could significantly affect the role that cooperatives play in society today from a theoretical standpoint.

According to Gurumoorthy (2000), SHGs can support the achievement of rural development objectives and promote community participation in all projects of this kind. A Self-Help Group (SHG) is an effective framework for providing microcredit to people living in rural areas in an effort to encourage and empower them to start their own businesses. SHGs are able to provide for all of the credit demands of rural residents. The Self-Help Groups (SHGs) have proven their ability to efficiently mobilize and manage funds, evaluate credit needs, maintain communication with financial institutions, and promote ethos among their members.

Satyasai's (2021) article aimed to evaluate SHGs' efficacy, especially with regard to their capacity to raise members' social and economic status. The basic data for the study was gathered using an organized questionnaire that was distributed to 560 sample families from 223 SHGs spread across 11 states and four regions of the country. According to the research, SHGs can assist the socially and economically disadvantaged in rural areas by intervening as a formal organization. The latter advantage was thought to be more important. Even though SHG success differed widely between regions, the south may turn

out to be better than the others. The SHG's program has been shown to be more popular in the southern region while making very little progress in other regions, suggesting a discrepancy in their respective levels of success.

Rajeshwari (2001) emphasized how women's self-help groups' development and the improvement of women's economic and social standing have been facilitated by non-governmental organizations' (NGOs) provision of microfinance to these groups. It is capable of managing all facets of a business, including fundraising, product procurement, and determining when and how to modernize and diversify operations.

According to Sinha (2012), self-help groups (SHGs) are unorganized groups of people that collaborate to achieve a shared objective. Having enough money on hand to meet urgent needs without turning to outside help is a typical objective. A savings and loan group's main objectives are to spread the idea of banking—that is, taking out a loan and paying it back on time—to the public, encourage a culture of frugal living, and expand credit availability to support economic growth.

Nature and Significance of Shgs Movement in India

The impoverished must first be assisted in forming organizations under the name of Self-Help Groups (SHGs) by the technical and helpful assistance of a suitably educated and helpful local person. He or she informs them of the advantages of group formation and the benefits of being financially secure. This individual is referred to as an "animator" or "implementer." In order to promote awareness of self-employment, the animator is typically someone who is well-known in the community: (Leader of the village; A person serving in a panchayat; An established local figure, such as a retired school teacher or government employee; A member of the State Government's development agency or department personnel, a health professional, or a field officer; Field officers, employees of local cooperative banks or societies, or staff members of commercial or regional rural banks and A field worker for an NGO). A rural woman who organizes a self-help group (SHG) can organize it more effectively. The groups cannot be arranged by the animators on their own. He or she will require instruction, preparation, books, and other resources. These organizations usually provide assistance: Organizations that are non-profit or voluntary (NGO). A department within the State Government responsible for development. The bank's local branch. Panchayat units.

Self-Help Groups (SHGs), founded by Nobel laureate Muhammad Yunus in the 1970s, introduced the idea, and it has since developed over several decades. The Swarn Jayanti Gram Swarajgaar Yojana (SGSY), launched by the

Indian government in 1999, aims to skill up SHGs and encourage self-employment in rural regions. The initiative changed in 2011 to become a national movement known as the National Rural Livelihoods Mission (NRLM). In 1992, it established the SHG Bank Linkage Project, which is currently the biggest microfinance initiative in the world. NABARD and the Reserve Bank of India permitted self-help groups (SHGs) to create savings bank accounts in banks in 1993. The Government of India (GOI) launched the Swarn Jayanti Gram Swarozgar Yojana in 1999 with the goal of fostering self-employment in rural regions by developing and empowering these kinds of groups. In 2011, this became the National Rural Livelihoods Mission (NRLM). The National Rural Livelihoods Mission (NRLM) of the Government of India, which is partially funded by the World Bank, assists women's self-help groups. With the expansion of the SHG model to 28 states and 6 Union Territories, NRLM has reached over 67 million women nationwide. Through the formation of the SHG concept, the women have leveraged an additional $37 billion from commercial banks and saved $1.4 billion (Government of India, 2011).

The interest rates on the loans that SHGs issue are extremely cheap, and they are less than what the unorganized sector charges. Numerous issues, such as poverty, illiteracy, skill gaps, lack of formal credit, etc., and these issues require group efforts to solve because they cannot be resolved on an individual basis. SHGs can therefore help the underprivileged and disenfranchised achieve change. To promote self-employment and reduce poverty, SHGs rely on the idea of "self-help." It aims to increase marginalized and impoverished people's functional capacity in the areas of employment and revenue-generating activities. It settles disputes through group leadership and communication. As a result, self-help groups have become the most successful way to provide the impoverished with microfinance services. The group members and their families can now work for themselves thanks to this bank loan, raising their standard of living. In rural India, self-help groups (SHGs) have played a significant role in rescuing impoverished farmers from debt and enabling them to live dignified lives. Self-help groups can fulfill a wide range of functions based on demands and circumstances. For instance, self-help organizations in the development sector are frequently concentrated on microcredit programs and revenue-generating endeavors since they have proven to be an effective tactic for reducing poverty, promoting human development, and empowering the social sector.

No.	State Name	Total Number of SHGs	Minority Category Wise Member					
			SC	ST	Minority	Others	Total Member	PWDs
State Name								
1	**Andhra Pradesh**	8,53,976	18,75,324	5,92,357	2,792	65,00,012	89,70,485	2,74,815
2	**Assam**	3,50,397	3,88,826	7,03,753	12,38,176	16,46,632	39,77,387	4,797
3	**Bihar**	10,55,316	29,98,598	2,25,159	13,85,094	75,85,609	1,21,94,460	5,844
4	**Chhattisgarh**	2,66,198	3,27,173	11,52,300	17,681	12,87,094	27,84,248	1,16,130
5	**Gujarat**	2,78,185	2,95,086	8,45,569	80,662	15,14,825	27,36,142	34,211
6	**Jharkhand**	2,80,250	4,96,245	9,84,015	1,90,577	13,93,037	30,63,874	22,159
7	**Karnataka**	2,70,351	5,81,095	2,65,560	1,62,719	20,97,741	31,07,115	1,17,701
8	**Kerala**	2,56,213	4,02,898	71,434	6,29,936	23,28,301	34,32,569	95,305
9	**Madhya Pradesh**	4,50,279	9,94,881	19,17,099	82,737	22,99,622	52,94,339	76,504
10	**Maharashtra**	6,16,376	8,18,560	9,14,406	2,21,240	41,66,710	61,20,916	1,12,923
11	**Odisha**	5,38,263	10,22,123	13,32,145	86,658	30,67,037	55,07,963	88,937
12	**Rajasthan**	2,60,861	7,10,139	9,07,880	91,475	11,59,429	28,68,923	62,613
13	**Tamil Nadu**	3,28,699	10,91,315	65,367	1,55,102	24,59,298	37,71,082	3,61,397
14	**Telangana**	4,40,253	10,19,535	6,36,072	1,50,480	29,43,737	47,49,824	18,234
15	**Uttar Pradesh**	7,35,817	26,55,411	79,395	4,83,013	45,27,946	77,45,765	2,78,621
16	**West Bengal**	10,87,585	36,77,457	7,79,642	28,97,659	38,14,760	1,11,69,518	95,137
Sub Total		80,69,019	1,93,54,666	1,14,72,153	78,76,001	48,79,17,90	8,74,94,610	17,65,328

Source: Government of India, 2024

Impact of Self-Help Groups on Empowerment of Women and Economic Growth

In our economy, women make up around half of the total resources. However, because of societal, cultural, and financial limitations, women are more impoverished and less fortunate than men. In rural and underdeveloped communities, the situation is worse. In order to end poverty, boost economic growth, and improve living standards, women's development initiatives must be prioritized. It is crucially important to prioritize women's development initiatives in order to end poverty, increase economic growth, and improve living standards. Self-help groups (SHGs) and bank linkage programs are becoming a viable option for reaching the "unreached poor" with financial services. These programs have not only helped rural women fulfill their financial needs, but they have also strengthened the poor people's ability to help themselves collectively, which has empowered them. The nation's women are currently engaged in an empowerment movement thanks to the SHGs' quick success (Tiyas Biswas, 2007).

There is a multiplier effect when you invest in women. Women "tend to keep nothing back for themselves; they contribute decisively to the well-being of their families," so just putting money in their hands (in the form of working

capital) can help them attain more economic independence and security and, as a result, boost their sense of self-worth, control, and empowerment. (Sucy Cheston and Lisa Kuhn, 2002). Through the mobilization of women around thrift and credit activities, SHG has changed the social attitude and status of women in the household and society, leading to economic self-reliance. A crucial programming tactic for the majority of women's development initiatives is SHG. C. Rangarajan chaired a committee to report on 'Financial Inclusion in the Country', which identified four primary factors for the absence of financial inclusion. Inability to offer collateral security, limited credit absorption capacity, inadequate institutional reach, and a weak community network. Women's SHGs and panchayat leaders are working to discover more meaningful answers to development concerns.

Women SHGs participate in gram sabha meetings and contribute to gram panchayat development initiatives. Over 1 lakh SHG women have been trained to conduct social audits on programs to promote accountability in the community. Financial resources from ongoing rural programs prioritize villages with DAY-NRLM women SHGs. The Ministry of Rural Development and community-based training institutions offer chances for skilling and diversifying livelihoods. SHGs empower women to make decisions at both the home and community levels. SHG programs effectively mobilize community resources that are currently underutilized. The situation worsened as banks shifted from rural to urban India. The collapse of commercial banking in rural areas hinders financial inclusion and slows growth. Empowered women are more engaged in gram sabha and elections. Research indicates that female SHG leaders are frequently selected as candidates for Panchayat Pradhans or representatives in the Panchayati Raj Institution (PRI). The government should promote and facilitate the SHG movement by creating a supportive atmosphere for its growth and development. Expanding SHG Movement to Credit-Deficient Areas, including Madhya Pradesh, Rajasthan, and the North-East states. These states have rapidly expanded their financial infrastructure, notably NABARD, and implemented major IT-enabled communication and capacity-building efforts.

The Economic Survey 2022-2023, which was delivered to Parliament on January 31 by the Union finance minister, highlights the women-led self-help groups (SHGs) in India as a little-known but highly influential banking sector that disburses billions of rupees annually. With around 12 million SHGs, 88% of them are exclusively made up of women. These groups are often made up of 20–25 people, most of whom are village inhabitants. These organizations were connected to banks in 1992 in order to receive small loans for starting businesses like livestock rearing or tailoring. This initiative was known as the SHG Bank Linkage Project, or SHG-BLP. The robust balance sheets of India's

commercial banks have been highlighted multiple times in the Economic Survey 2022-2023 report. Large-scale loan waivers for non-performing assets are largely to blame for this. The government raised the maximum amount that SHGs could borrow without collateral in 2021—from Rs 10 lakh to Rs 20 lakh—as part of the COVID-19 epidemic stimulus package. 68.5 million families and 6.3 million women's self-help groups apparently profited from this. The Economic Survey, a report on the status of the economy and suggestions for important development policies, makes the case that women's self-help groups (SHGs) should be at the forefront of rural development since they have already shown themselves to be successful local community institutions. It should be mentioned that the agriculture industry employs more than 75% of female workers in rural areas. This suggests that women need to be upskilled and given jobs in agriculture-related fields like food processing. In this context, self-help groups (SHGs) can be extremely important in helping rural women realize their full potential in terms of financial inclusion, diversification of sources of income, and skill development. The report suggests that these organizations be given additional support in the form of loans and markets for the produce they grow (Mahapatra, 2023)

Conclusion

In conclusion, this review paper has explored the extensive scope and impactful outcomes of self-help groups (SHGs) in India. SHGs have emerged as a potent tool for socio-economic empowerment, particularly among marginalized communities, women, and rural populations. Through a comprehensive analysis of existing literature, this review highlights several key findings: Firstly, SHGs play a pivotal role in fostering financial inclusion by providing access to credit, savings, and financial services to those who are traditionally excluded from formal banking systems. This access to financial resources empowers individuals to start or expand their own businesses, thereby generating income and improving their standard of living. Secondly, SHGs serve as platforms for social mobilization and collective action, enabling members to address common issues such as healthcare, education, and infrastructure development. By pooling their resources and leveraging collective strength, SHGs can advocate for their rights and influence policy decisions at local and regional level. According to the study, joining SHGs is more than simply for credit; it is also a means of empowerment. Women who participate in self-help groups gain economic and social empowerment. Empowerment cannot be supplied; it must be self-generated, allowing individuals to take charge of their lives.

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A Study of CSR Activities Adopted by Various Corporates in India

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Abstract

This paper comprehensively explores Corporate Social Responsibility (CSR) practices among Indian corporations, aiming to provide a nuanced understanding of their strategies, motivations, and impacts. Employing a mixed-method approach, it combines quantitative data analysis from annual reports and financial data with qualitative insights from interviews and case studies. Key findings reveal diverse CSR approaches, influenced by regulatory frameworks, industry norms, and stakeholder expectations. The study identifies sector-specific patterns and examines challenges such as measurement and stakeholder engagement. By contributing to the understanding of CSR in India, this research informs policymakers, practitioners, and academics, serving as a foundation for future studies in emerging economies.

Keywords: CSR, policy, economy.

Introduction

Corporate Social Responsibility (CSR) has become an essential aspect of business operations for companies across the globe, and India is no exception. CSR initiatives in India have gained significant momentum in recent years, with various companies actively engaging in a range of activities aimed at contributing to the social and environmental well-being of the country. This report provides an in-depth analysis of the various activities undertaken by different companies for CSR initiatives in India. The report begins with an overview of the CSR landscape in India, highlighting the regulatory framework and the mandatory CSR spending requirements for companies. It then delves into the different types of CSR activities undertaken by companies in India, including education, health, environment, poverty alleviation, and disaster relief.

- **One of the *key areas of focus for CSR initiatives in India is education***

Many companies have undertaken various activities aimed at improving access to quality education for underprivileged children. Tata Steel has

established over 100 schools in remote areas of India, providing education to over 30,000 children. Wipro has established over 200 schools in rural areas, providing education to over 50,000 children. These initiatives have played a significant role in improving literacy rates and reducing the gender gap in education in India.

- ***Health is another critical area of focus for CSR initiatives in India***

Companies have undertaken various activities aimed at improving access to healthcare services for underprivileged communities. Reliance Industries has established over 100 primary healthcare centers in remote areas of India, providing healthcare services to over 2 million people. Mahindra & Mahindra has established over 50 mobile health clinics, providing healthcare services to over 500,000 people in remote areas. These initiatives have played a significant role in improving healthcare outcomes and reducing the burden of disease in India.

- ***Environment is a third area of focus for CSR initiatives in India***

Companies have undertaken various activities aimed at promoting sustainable development and reducing their carbon footprint. For instance, Infosys has implemented a range of green initiatives, including the use of renewable energy, water conservation, and waste management, resulting in a significant reduction in their carbon footprint. Similarly, Tata Consultancy Services has implemented a range of green initiatives, including the use of electric vehicles, green building design, and waste management, resulting in a significant reduction in their carbon footprint. These initiatives have played a significant role in promoting sustainable development and reducing the impact of climate change in India.

Poverty alleviation is another critical area of focus for CSR initiatives in India.

Companies have undertaken various activities aimed at improving the livelihoods of underprivileged communities. For instance, Hindustan Unilever has established over 100 self-help groups in rural areas, providing training and resources to over 10,000 women. These initiatives have played a significant role in improving the economic conditions of underprivileged communities and reducing poverty in India.

- ***Disaster relief is a fifth area of focus for CSR initiatives in India.***

Companies have undertaken various activities aimed at providing relief and support to communities affected by natural disasters. For instance, the Tata

Group has provided relief and support to communities affected by floods, cyclones, and earthquakes, providing food, shelter, and medical services. Similarly, the Reliance Group has provided relief and support to communities affected by natural disasters, providing food, shelter, and medical services. These initiatives have played a significant role in providing support and relief to communities affected by natural disasters in India.

The report concludes with a discussion on the challenges and opportunities for CSR initiatives in India. While there have been significant achievements in CSR initiatives in India, there are still several challenges that need to be addressed. These include the need for better monitoring and evaluation of CSR initiatives, the need for greater collaboration between companies and civil society organisations, and the need for a more enabling regulatory framework. However, there are also significant opportunities for CSR initiatives in India, including the potential for leveraging technology to improve the impact and reach of CSR initiatives, the potential for partnerships between companies and the government to address social and environmental challenges, and the potential for CSR initiatives to contribute to the achievement of the Sustainable Development Goals.

Significance of CSR

The significance of Corporate Social Responsibility (CSR) activities in India is profound and multifaceted. CSR plays a crucial role in the development of the country by supporting education, providing healthcare, and protecting the environment. It helps companies to be more accountable to their stakeholders, boost their reputations, reduce risks, and increase productivity. By engaging in CSR initiatives, companies not only improve the lives of individuals and communities but also contribute to the overall development of the nation.

In India, CSR is mandated by the Companies Act of 2013, requiring certain companies to spend a percentage of their profits on CSR activities, leading to an increase in spending on initiatives such as education, healthcare, and environmental conservation. CSR initiatives are essential for bridging gaps in education, healthcare, and sustainability, fostering inclusive growth, building brand trust, and attracting skilled talent, benefiting both society and businesses.

Furthermore, CSR positively impacts the Indian economy by contributing to community development, job creation, and fostering a skilled workforce, enhancing human capital and long- term economic growth. The future trends in CSR spending in India indicate a significant increase, with a focus on sectors like climate action, education, renewable energy, and technology-driven solutions, aligning with UN Sustainable Development Goals.

Legal Frameworks

In India, Corporate Social Responsibility (CSR) is a mandatory requirement for companies that meet certain financial thresholds, as outlined in the Companies (Corporate Social Responsibility Policy) Rules, 2014. The rules were amended in 2022 by the Ministry of Corporate Affairs (MCA) to enhance the CSR regulatory framework. Companies with a net worth of at least 500 crore rupees, annual turnover exceeding 1000 crore rupees, or net profits surpassing 5 crore rupees are subject to CSR regulations. Foreign corporations with a branch or project office in India must also comply if their operations meet these financial thresholds.

Companies must constitute a CSR committee responsible for formulating and presenting an annual CSR strategy for the board's approval, crafting, endorsing, and overseeing the implementation of the company's CSR policy, and ensuring alignment with regulatory frameworks. The Companies (Corporate Social Responsibility Policy) Amendment Rules, 2022 introduced several key changes, including the mandatory establishment of a dedicated CSR committee to oversee the execution of CSR initiatives and the management of funds within the "Unspent Corporate Social Responsibility Account."

The Amendment Rules also require companies to provide detailed reports of their CSR activities, including an executive summary and web links to the impact assessments of CSR projects. Companies must disclose the allocation of CSR funds to both ongoing and non-ongoing projects, detailing any surplus funds available for offsetting and the unspent CSR amounts from the past three fiscal years. Companies must also report any capital assets acquired or created through CSR expenditures within the financial year.

Form CSR-2, introduced on 11 February 2022, is a detailed reporting format that aligns with good corporate governance practices. It mandates companies to furnish detailed reports of their CSR activities, including CSR expenditure for the three preceding financial years, information on all ongoing CSR projects, details about the company's CSR Committee, and disclosure of CSR details on the company's website. Companies must also provide details of any capital assets created or acquired through CSR funds, including the location, pin code, amount spent, and the useful life of such assets.

Objectives

- To provide an overview of the concept of Corporate Social Responsibility.
- To highlight the regulatory framework governing CSR activities in India.

- To showcase various CSR activities undertaken by different companies.
- To provide a comprehensive understanding of the CSR landscape in India.

Literature Review

This summary explores Corporate Social Responsibility (CSR) through 15 key research papers.

The concept of CSR builds upon stakeholder theory, which argues that businesses should prioritize the well-being of all stakeholders, not just shareholders. This challenge the traditional model focused solely on maximizing shareholder profits. Porter and Kramer (2011) propose "Creating Shared Value," suggesting companies can address social and environmental issues while achieving success, aligning with stakeholder theory.

While stakeholder consideration is important, a key question remains: does CSR benefit companies financially? While Friedman (1995) argues CSR distracts from profit maximization, others present a contrasting view. Porter (1991) suggests well-designed CSR initiatives can enhance brand reputation, customer loyalty, and employee engagement, ultimately leading to stronger financial performance. Elkington (2000) popularizes the Triple Bottom Line concept, urging companies to consider social, environmental, and financial performance for long-term sustainability. Canis (2010) supports this view with research on the positive economic and financial effects of CSR.

Integrating CSR into corporate strategy can be challenging. Ansoff (2007) explores how to weave CSR into business operations. However, measuring CSR performance poses significant difficulties. Spence (2004) and Wallis (2010) highlight the complexity of quantifying social and environmental impacts.

Perrow (2006) examines how legal frameworks, social norms, and industry standards influence how companies approach CSR. Freeman (2011) calls for a "next wave" of CSR, emphasizing stakeholder capitalism with a long-term perspective. This aligns with the growing focus on environmental, social, and governance (ESG) factors in investment decisions. However, Donaldson (2011) explores the inherent "paradoxes" of CSR. Companies face challenges in balancing social and environmental goals with profitability.

These papers provide a comprehensive exploration of CSR, highlighting its importance in the modern business world. The ongoing debate over financial benefits and the challenges of implementing CSR demonstrate its complexity.

As stakeholder demands for responsible corporate behavior increase, CSR remains a crucial consideration for businesses seeking long-term success and positive societal impact.

Research Methodology

The research methodology for this report on "Various activities done by different companies for CSR initiatives in India" will involve a comprehensive review of existing literature, case studies, and reports on CSR initiatives in India. The following steps will be taken to ensure a well-rounded and detailed report:

- **Literature Review**: A thorough literature review will be conducted to gain a comprehensive understanding of the concept of CSR, its history, and its evolution in India. This will include an analysis of the regulatory framework, the mandatory CSR spending requirements for companies, and the various types of CSR activities undertaken by companies in India. The literature review will also include an analysis of the impact and challenges of CSR initiatives in India.

- **Data Collection:** Data will be collected from various sources, including annual reports, sustainability reports, and websites of companies, as well as reports and publications of industry associations, research organizations, and government agencies. The data will be collected on the various activities undertaken by companies for CSR initiatives, the impact of these activities, and the challenges faced in implementing CSR initiatives.

- **Case Studies:** Case studies of selected companies will be conducted to gain a deeper understanding of the CSR initiatives undertaken by them, the impact of these initiatives, and the challenges faced. The case studies will be selected based on the size, sector, and location of the companies, as well as the nature and scope of their CSR initiatives.
- **Data Analysis:** The data collected will be analysed to identify trends, patterns, and insights. The analysis will include a comparative analysis of the CSR activities undertaken by different companies, the impact of these activities, and the challenges faced.

- **Interviews:** Interviews will be conducted with key stakeholders, including company executives, CSR experts, and representatives of industry associations, research organisations, and government agencies.

- **Report Writing:** The report will be written based on the data collected, the analysis conducted, and the insights gained from the case studies and interviews.

The research methodology will ensure a well-rounded and detailed report on the various activities done by different companies for CSR initiatives in India. The report will provide insights into the impact and challenges of CSR initiatives in India, and the best practices adopted by companies. The report will be useful for policymakers, companies, and researchers interested in CSR initiatives in India.

Finding and Result

Corporate Social Responsibility (CSR) initiatives are a crucial aspect of modern business practices, and companies in India are increasingly embracing this concept to contribute positively to society and the environment. This report focuses on the CSR activities of various companies operating in India, including ITC, Disney, Coca-Cola, Starbucks, Honda, Vedanta, Reliance, Google, Indian Oil, and Tata Consultancy Services (TCS).

ITC is a leading Indian conglomerate with a diversified business portfolio, including fast- moving consumer goods, hotels, paperboards, and packaging. ITC's CSR initiatives are primarily focused on rural development, women's empowerment, and environmental sustainability. The company's flagship CSR program, "Social and Farm Forestry," has planted over 86 million trees, contributing to environmental conservation and rural livelihoods.

Disney, a global entertainment and media company, has been involved in various CSR activities in India, focusing on children's education, health, and well-being. The company has partnered with local NGOs and government bodies to implement these initiatives, which include setting up learning centers, providing educational materials, and promoting health and hygiene awareness.

- **Strict CSR Compliance:** The Companies (Amendment) Act, 2019, has introduced stricter provisions for CSR compliance, requiring companies to deposit unspent CSR funds into a prescribed fund within three years of transfer, failing which the fund must be deposited into one of the specified funds. The new law also prescribes monetary penalties and imprisonment for non-compliance.

- **CSR Trends:** Since the applicability of mandatory CSR provisions in 2014, CSR spending ***Coca-Cola***, a multinational beverage company, has been actively engaged in CSR activities in India, focusing on water

conservation, community development, and youth empowerment. The company's "Support My School" campaign has positively impacted over 10,000 schools across India, providing improved infrastructure and facilities for students.

- **Starbucks**, a global coffee chain, has been promoting sustainable coffee farming practices and supporting local coffee-growing communities in India. The company has also been involved in various community development initiatives, including education, health, and livelihood projects.

- **Honda**, a Japanese automobile manufacturer, has been focusing on road safety, skill development, and environmental sustainability in its CSR initiatives in India. The company has set up driving schools, conducted road safety awareness campaigns, and implemented green initiatives in its manufacturing plants.

- **Vedanta,** a natural resources company, has been involved in various CSR activities in India, focusing on education, health, livelihood, and environmental sustainability. The company's CSR initiatives include setting up schools, health centers, and skill development centers in the regions where it operates.

- **Reliance**, one of India's largest conglomerates, has been actively involved in CSR activities, focusing on education, health, rural transformation, and disaster response. The company's CSR arm, Reliance Foundation, has been instrumental in implementing these initiatives, reaching out to millions of individuals across the country.

- **Google,** a global technology company, has been focusing on digital literacy, internet safety, and environmental sustainability in its CSR initiatives in India. The company's "Internet Saathi" program has trained over 20 million women in rural India on digital literacy, empowering them with access to information and opportunities.

- **Indian Oil**, a state-owned oil and gas company, has been involved in various CSR activities, focusing on energy conservation, environmental sustainability, and community development. The company's CSR initiatives include setting up solar power plants, promoting clean cooking stoves, and implementing community development projects in the regions where it operates.

- **Tata Consultancy Services (TCS)**, a leading IT services company, has been focusing on digital literacy, skill development, and environmental sustainability in its CSR initiatives in India. The company's CSR arm, TCS Foundation, has been instrumental in implementing these initiatives, reaching out to millions of individuals across the country.

The following conclusions can be drawn from the research on various activities done by different companies for CSR initiatives in India:

- **Green CSR Projects:** Companies in India are actively engaged in green CSR projects, focusing on environmental sustainability, waste management, and renewable energy. Examples include Cummins India Ltd., DB Corp Ltd., Century Plyboards India Ltd., Tata Sponge Iron, and Bharat Heavy Electricals Ltd., which have implemented various green initiatives to reduce their carbon footprint and contribute to sustainable development.

- **Community Development:** Several companies are investing in community development projects, focusing on education, health, and livelihood. The Tata Group, for instance, carries out various CSR projects, primarily community improvement and poverty alleviation programs. Reliance Industries Limited (RIL) also features among the top 50 companies in CSR activities funding in India, with a significant focus on community development.

- **Digital Literacy and Skill Development:** Companies like Google and TCS are focusing on digital literacy and skill development initiatives, empowering individuals with access to information and opportunities. Google's "Internet Saathi" program has trained over 20 million women in rural India on digital literacy, while TCS has been promoting skill development and sustainable relationships with the community.

- **COVID-19 Relief:** During the COVID-19 pandemic, companies have been contributing to relief efforts by spending their CSR funds on various activities related to healthcare, preventive healthcare, and disaster management. DLF Ltd., for example, has focused on COVID-19 relief, vaccination, medical equipment donations, health screening camps, mental health, promotion of sports, and environmental sustainability by corporate India has increased significantly. In 2018, companies spent 47 percent higher compared to the amount in 2014-15, contributing US$1 billion to CSR initiatives.

- **CSR Policy and Implementation:** Companies have established specific departments and teams for CSR initiatives, developing policies, strategies, and goals that align with their business domain. CSR policies ensure compliance with legislation and respect for the growth and development of marginalized communities and the environment, while also being sustainable and not negatively affecting the organization's operations.

Limitations

The following limitations should be considered in the context of CSR practices in India:

- **Regulatory Compliance Challenges**: One of the primary limitations of CSR initiatives in India is the challenge of regulatory compliance. While the Companies Act, 2013 mandates certain companies to spend a percentage of their profits on CSR activities, ensuring full compliance and adherence to the prescribed guidelines can be complex and resource-intensive. Companies may face difficulties in accurately reporting and monitoring their CSR expenditures, leading to potential non-compliance issues and penalties.

- **Lack of Transparency and Accountability:** Another significant limitation is the lack of transparency and accountability in CSR reporting. The Standing Committee on Finance has highlighted the insufficiency of information regarding CSR spending by companies, making it difficult for stakeholders to assess the actual impact of these initiatives. Without transparent reporting mechanisms and robust monitoring systems, the credibility and effectiveness of CSR activities may be compromised.

- **Resource Allocation and Budget Constraints**. - Companies often face challenges in allocating sufficient resources and budgets for CSR initiatives. Balancing financial commitments to CSR projects with other operational expenses can be a delicate task, especially for companies operating in competitive industries or facing financial constraints. Limited budgets may restrict the scale and impact of CSR programs, hindering their ability to address critical social and environmental issues effectively.

- **Scope and focus of CSR Activities:** The scope and focus of CSR activities undertaken by companies may vary, leading to inconsistencies in addressing key social and environmental challenges. Companies may

prioritize certain CSR areas over others based on their business interests or stakeholder expectations, potentially overlooking critical issues that require urgent attention. This selective approach may limit the overall impact of CSR initiatives on broader societal development.

- **Measuring Impact and Evaluation:** Evaluating the impact of CSR initiatives and measuring their effectiveness poses a significant challenge for companies. Establishing clear metrics, benchmarks, and evaluation frameworks to assess the outcomes of CSR projects can be complex, especially when dealing with long-term social and environmental issues. Without robust impact assessment mechanisms, companies may struggle to demonstrate the tangible benefits of their CSR efforts to stakeholders and the public.

- **Capacity Building and Stakeholder Engagement:** Engaging stakeholders, building partnerships, and mobilizing resources for CSR projects require significant capacity and expertise. Companies may lack the necessary skills, knowledge, and networks to effectively collaborate with local communities, NGOs, and government agencies. Inadequate stakeholder engagement and capacity building efforts can limit the sustainability and scalability of CSR initiatives, hindering their long-term impact.

Conclusion

In conclusion, while CSR initiatives play a vital role in promoting sustainable development and social welfare in India, it is crucial to recognize and address the limitations that can affect the implementation and outcomes of these initiatives. Overcoming regulatory challenges, enhancing transparency, optimizing resource allocation, aligning CSR activities with societal needs, improving impact measurement, and strengthening stakeholder engagement are key areas that companies need to focus on to enhance the effectiveness and sustainability of their CSR programs.

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Investigating India's Jan Aushadhi Kendra

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Abstract

The present paper attempts to understand the social welfare scheme, the Pradhan Mantri Jan Aushadhi Kendra Pariyojana under the auspices of the Government of India, attempting to understand and analyze the functioning, impact and success of Jan Aushadhi Kendras and to identify challenges and opportunities for the further expansion and improvement of Jan Aushadhi Kendras

Keywords: welfare, impact, challenge, opportunities

Introduction

The Pradhan Mantri Jan Aushadhi Kendra Pariyojna formerly known as Bhartiya Janaushadhi Yojna was introduced by the Ministry of Chemicals & Fertilizers in November, 2008, under Pharmaceuticals and Medical Devices Bureau of India (PMBI) as the implementing body.

The Yojna helps the consumers get their needed medicines 50%-90% cheaper than that of the branded medicines available in the open market.
As per the data available on the official website of PMBI, the official implementing body of the Yojna, as on 31.3.2023, 9303 Jan-Aushadhi Kendras are functional across the country.

The product basket of the Kendras include about 1800 drugs and generic medicines and about 290 medical instruments. As an estimation by the PMBI's official website, the scheme has achieved savings of upto Rs.20,000 crores of the common citizens of the country till date

One of the key programmes in the Government of India's comprehensive goal to guarantee universal access to high-quality, reasonably priced healthcare is Jan Aushadhi Kendra (JAK). Jan Aushadhi Kendras, which were established with the goal of granting all citizens, regardless of socioeconomic background, access to necessary medications, are a key component in the transformation of India's pharmaceutical industry.

Objectives of the Report

- To analyze the functioning, impact and success of Jan Aushadhi Kendras.
- To identify challenges and opportunities for the further expansion and improvement of Jan Aushadhi Kendras.

Proposed Hypothesis

A proposed hypothesis for PMBJP could be "Hypothesis: Implementation of the Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PMBJP) leads to improved access to essential medicines and reduces healthcare expenditure for individuals and the government yet its success remains questionable." To test this hypothesis, data could be collected on the ground level functioning of the kendras, their operations in reality and comparison with the success of other healthcare schemes in order to evaluate the impact of PMBJP.

Additionally, we can develop hypothesis for achieving our research objectives- Our hypotheses suggests that in order to gain deeper insight on the functioning and impact of the PMJAKY, we must gain direct contact with the Aushadhi Kendra owners and workers to get detailed insights to their ground level operations and reality of the scheme.

Our hypotheses and understanding suggests that the ground level reality of the scheme is not streamlined with the government's plans and lack of awareness among the people regarding the scheme and the actual operations falling short at ground level may prove to be the reasons why the Pradhan Mantri Jan Aushadhi Kendra Yojna lacks behind.

Methodology

- **Data Collection:** Primary data was gathered through interviews with managers and customers of Jan AushadhiKendras. Secondary data was collected from government reports, research papers, and official websites.

- **Research Design:** A qualitative approach was employed to gain insights into the perceptions and experiences of stakeholders.

- **Sampling Techniques:** Convenient sampling was utilized to select participants for interviews.

- **Tools or Instruments Used:** Semi-structured interviews and content analysis of secondary data were the primary research tools.

Literature Review

The Pradhan Mantri Jan Aushadhi Kendra was founded by the Indian government to provide the general public with affordable, superior generic. The programme aims to lower healthcare costs for regular people and provide access to care for everybody. Despite the efforts of the programme, there is a dearth of public awareness regarding the accessibility of the medications offered by these centers.This study will examine customers' awareness, attitudes, and views of Pradhan Mantri Jan AushadhiKendra in order to better understand how they see it. The study will investigate how well-informed consumers are about the availability and caliber of the medications offered by these facilities. The study will also assess how clients feel about these facilities and how well the medications are provided.

Survey

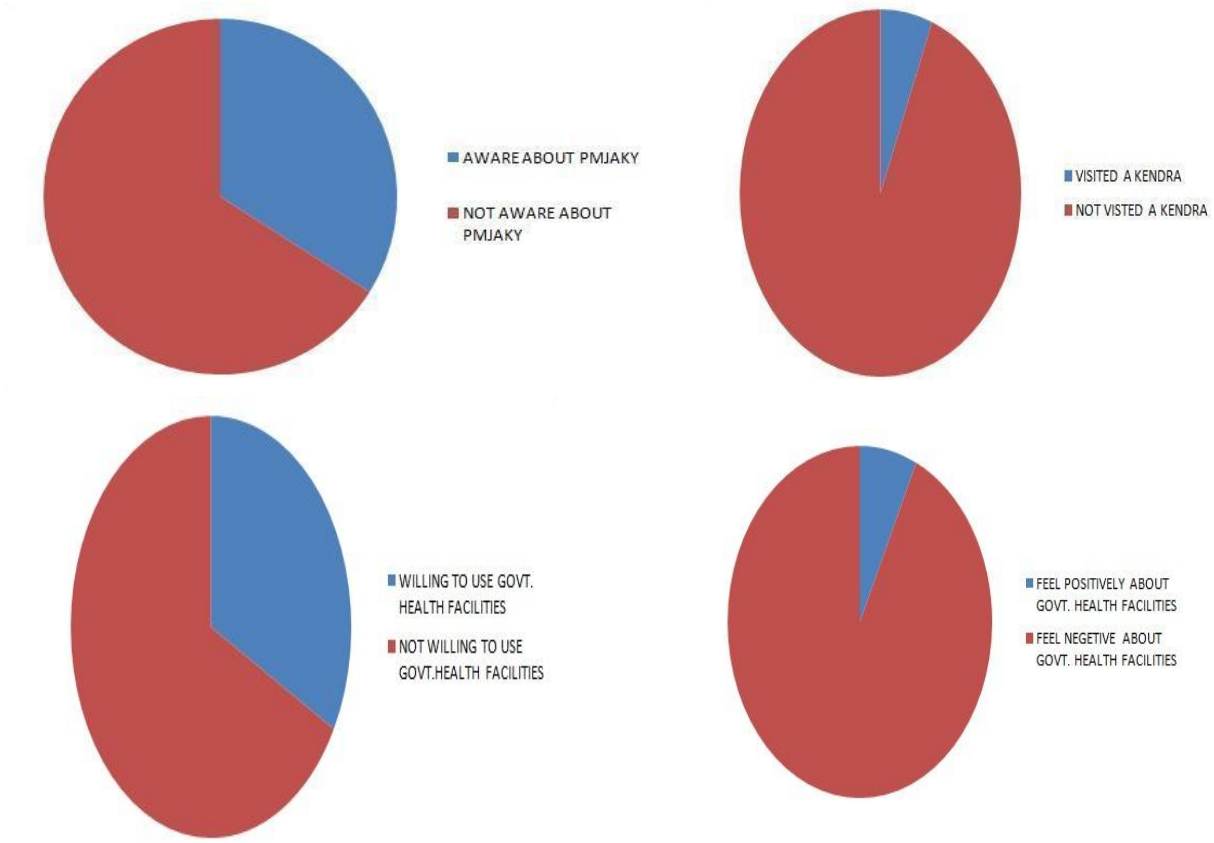
With the aim of targeting the awareness of the yojana among the people, we conducted a survey by handing out questionnaires in both physical and online mediums.

We handed out 50 physical questionnaires and sent 50 online questionnaires to get our results.

We also interviewed several Aushadhi Kendra owners and workers to attain ground level knowledge of the operations and functioning of the kendras.

Cumulatively form both the Google Forms results and the responses from the physical questionnaires, we can conclude the following facts:-

- 66% of the respondents were not aware of the PMJAKY.
- Only 6% of the 34% people who are aware have actually visited the kendras i.e. 94% people, even though aware have not visited any Kendra.
- Only 13% of the respondents had a Jan Aushadhi Kendra in their known local area.
- Apart from the AushadhiKendras, 33% respondents are willing to use other government healthcare services but only 7% respondents feel that the Government Healthcare Infrastructure is up to the mark.
- Result of the survey –



From all this data collected we can conclude that significant improvements in terms of awareness of the medical facilities that the government provides.

From surveying the Kendra owners and workers, we gained the following information:-

- The Kendra owners are responsible for procurement of the medicines, paying rent and all other associated expenses.
- Revenues for the Kendra owners are in the form of profits only.
- Role of government is limited to providing licenses for buying and selling of medicines.
- Majority of the Kendras do not receive sufficient footfall to operate profitably.
- There are also instances where the ordered medicines do not arrive timely to the Kendras.
- The number of aushadhi kendras operational at the ground level is far less than the number government claims to be operational, lack of footfall and lack of profitability are two major reasons for this.

Findings

- **Accessibility:** Jan AushadhiKendras have significantly increased access to affordable medicines, particularly in rural and underserved areas. By setting up these Kendras in remote locations where healthcare facilities are scarce, the government has ensured that even the most marginalized communities have access to life-saving drugs.

- **Affordability:** Generic medicines available at these Kendras are priced substantially lower than their branded counterparts, making them accessible to economically disadvantaged individuals. The generic medicines available at these Kendras are priced substantially lower than their branded counterparts, often costing a fraction of the price. This affordability aspect is particularly beneficial for economically disadvantaged individuals who may otherwise struggle to afford expensive branded drugs.

- **Awareness:** While awareness about Jan Aushadhi Kendras has increased, further efforts are needed to reach remote communities and inform them about the benefits of generic medicines. While Jan AushadhiKendras have made significant strides in improving accessibility and affordability of medicines, there is still work to be done in terms of raising awareness about their existence and benefits, particularly in remote and marginalized communities. Many people, especially those living in rural areas, may still be unaware of the concept of generic medicines or the presence of Jan AushadhiKendras in their vicinity.

Limitations of Research

- **Funding Constraints:** Research requires financial resources for designing studies, procuring materials, conducting experiments, and analyzing data. Jan AushadhiKendras may face funding constraints that limit their ability to invest in research activities.

- **Limited Research Infrastructure:** Many Jan Aushadhi Kendras operate in resource-constrained environments with limited research infrastructure. This may include a lack of laboratory facilities, equipment, and skilled personnel necessary for conducting robust research studies.

- **Lack of Expertise:** Conducting research requires expertise in research methodologies, data analysis, and interpretation of results. Jan Aushadhi

Kendras may lack staff with the necessary research skills and experience, making it challenging to undertake rigorous research studies.

- **Regulatory Hurdles:** Research involving human subjects or clinical trials must adhere to stringent ethical and regulatory guidelines. Jan Aushadhi Kendras may encounter challenges in navigating these regulatory requirements, which can hinder their ability to conduct research involving human participants.

- **Limited Access to Data:** Access to comprehensive and reliable data is crucial for conducting meaningful research. Jan Aushadhi Kendras may have limited access to patient data, medication usage patterns, and healthcare outcomes, which can restrict the scope of research studies they can undertake.

- **Publication Bias:** There may be a tendency to prioritize research with positive or significant findings for publication, while studies with null or negative results may remain unpublished. This publication bias can distort the overall body of evidence and hinder the dissemination of valuable research findings from Jan Aushadhi Kendra yojna.

A Comparative analysis with other Government health schemes

Along with the P.M. Jan Aushadhi Kendra Yojna, there are several other government based health schemes available to the public like Ayushman Bharat Yojna, P.M. Suraksha Bima Yojna, Aam Admi Bima Yojna and Mahatma Jyotiba Phule Jan Arogya Yojna. All these government schemes have shown a positive impact on the society and provided great service to the needy yet some yojnas are not as effective on the ground level as they are intended to be.
P.M. Suraksha Bima Yojna(PMSBY), launched by the Ministry of Finance back in 2015, P.M. Jan Arogya Yojna(PMJAY) launched by the Ministry of Health and Welfare in 2018 and Ayushman Bharat Yojna(PMABY)launched by Ministry of Health and Welfare in 2018 are some of the highly effective government schemes at the ground level.

The government's goal of PMSBY at the time of initiation was to at least cover 12.76cr. Persons and achieved an astounding 28.37cr coverage with about 99.75% settlement rate.

PMJAY, one of the facilities under the Ayushman Bharat Yojna saw a substantial footfall of more than 315cr and new Ayushman Bharat health accounts with 31,11,96,965 persons and new registrations in medical facilities of 1,92,766.This again shows results obtained beyond the set goals.

On the contrary, the Pradhan Mantri Jan Aushadhi Kendra Yojna which was initiated with a set target of opening 10,000 aushadhi kendras across India falls short in its ambitions to achieve their target with only 9,303 operational kendras and over 15% of the kendras don't align with the governments' grand vision.

The difference in the effectiveness of schemes at ground level is a clear indicator that even though significant efforts were made to achieve the vision for PMJAKY, it still falls short on the goals at ground level, whereas on the contrary, other major government health schemes have seen great success in achieving their targets.

From the statistical data provided by the Press Information Bureau (PIB), we can clearly see the difference in the ground level effectiveness of these schemes.

Limitations of PMJAKY

The Government of India's Jan Aushadhi Scheme (JAS) is a scheme designed to make generic medications accessible at reasonable costs, challenging the private pharmaceutical industry's unreasonable drug prices. The main obstacles to the JAS's poor success have been noted to include low public awareness, state government distribution of free medications, a weak supply chain, a lack of support for the programme, and doctors' refusal to prescribe generic medications.The administration has declared that it will open 10,000 new Jan Aushadhi Centers by the end of the year, but the program's implementation has not lived up to the lofty expectations it set forth. Subsequent governments have not fulfilled their initial promises for more than 15 years since the program's founding. Even though there are 9,303 Jan Aushadhi stores at the moment all over the nation, the schemes idealistic picture does not match the actual situation.

- **Restricted Availability:** Not all patients may require all of the meds that Jan Aushadhi Kendras stock. There may not be access to certain specialized or uncommon medications.

- **Quality Concerns:** Although every attempt is taken to guarantee the quality of medications, there may occasionally be problems with the generic drugs supplied by Jan Aushadhi Kendras in terms of quality control. Maintaining a high standard of quality can be difficult.

- **Infrastructure and Staffing:** There may be issues with staffing and infrastructure at some Jan Aushadhi Kendras. For efficient operations and satisfied customers, there must be enough facilities and skilled staff.

Proposed Suggestions for Improvement of PMJAKY

- **Awareness Campaigns:** It's imperative to conduct extensive awareness campaigns to ensure that the general public, especially those in rural and remote areas, are informed about the benefits and availability of affordable generic medicines through PMJAY. These campaigns can utilize various media platforms such as television, radio, newspapers, and social media to reach a wide audience and educate them about the scheme.

- **Expansion of Jan Aushadhi Kendras (JAKs):** The expansion of Jan Aushadhi Kendras is crucial for improving access to affordable medicines, particularly in underserved regions. By increasing the number of JAKs and strategically locating them in areas with limited healthcare facilities, we can ensure that a larger segment of the population can avail themselves of the benefits of PMJAY without having to travel long distances.

- **Enhanced Range of Medicines:** To cater to a broader spectrum of medical conditions and treatment needs, it's essential to expand the range of generic medicines available at Jan Aushadhi Kendras. By diversifying the inventory to include medications for various ailments, we can better meet the healthcare requirements of the population and further reduce their out-of-pocket expenses on medicines.

- **Quality Assurance:** Ensuring the quality of medicines available at Jan Aushadhi Kendras is paramount to building trust among consumers. By strengthening quality control measures and sourcing medicines only from WHO-GMP certified manufacturers, we can guarantee that all medications meet stringent quality standards and are safe for consumption.

- **Digital Integration:** In today's digital age, integrating PMJAY with online platforms and mobile applications can greatly enhance accessibility and convenience for users. By developing user-friendly interfaces that provide information about Jan Aushadhi Kendras, available medicines, and their prices, we can empower consumers to make informed decisions and easily locate the nearest JAKs.

- **Public-Private Partnership:** Collaborating with private healthcare providers and pharmaceutical companies can accelerate the expansion of PMJAY and leverage their expertise and resources to enhance its effectiveness. By forging partnerships, we can tap into additional resources, infrastructure, and expertise to further strengthen the implementation and reach of the scheme.

Subsidies and Incentives: Providing subsidies or incentives to pharmacists and healthcare professionals running Jan Aushadhi Kendras can incentivize their active participation and ensure the sustainability of the initiative. By offering financial support or other incentives, we can motivate them to maintain adequate stocks of generic medicines and provide quality service to consumers.

Feedback Mechanism: Establishing a feedback mechanism allows users to share their experiences, suggestions, and concerns related to Jan Aushadhi Kendras. By soliciting feedback from consumers, we can identify areas for improvement, address any issues promptly, and continuously enhance the quality of services provided at

JAKs.Streamlined Procurement Process: Simplifying and streamlining the procurement process for generic medicines is essential to ensure timely availability and prevent shortages at Jan Aushadhi Kendras. By optimizing the procurement process, we can minimize delays, improve inventory management, and ensure a steady supply of medicines to meet the demand effectively.

Integration with Healthcare Ecosystem: Integrating PMJAY with other healthcare initiatives and programs creates a more holistic and coordinated healthcare ecosystem. By aligning efforts across various healthcare sectors, we can address the diverse healthcare needs of the population, enhance healthcare delivery, and achieve better health outcomes for all. This integration fosters collaboration, synergy, and efficiency in the healthcare system, ultimately benefiting the entire community.

Enhancing transparency and accountability in the pharmaceutical sector will foster public trust and confidence in the quality and affordability of generic medications, thereby encouraging greater adoption and utilization.

Conclusion

`Regarding accessibility and affordability of healthcare, Jan Aushadhi Kendra is a ray of hope. Its founding represented a critical turning point in the effort to guarantee that necessary medications be distributed throughout the country, particularly to the poor. By virtue of its lofty goals and conscientious

operations, Jan Aushadhi Kendra has achieved remarkable progress in closing the gap between the cost and accessibility of generic medications.
The impact of Jan Aushadhi Kendra is evident in the lives of countless individuals who now have access to quality healthcare at prices within their means. By providing generic alternatives to expensive branded medications, JAK has not only alleviated the financial burden on households but has also empowered them to take charge of their health without compromise.

However, amidst its remarkable achievements, Jan Aushadhi Kendra encounters a myriad of challenges ranging from logistical hurdles to quality assurance concerns. These obstacles necessitate concerted efforts from policymakers, healthcare professionals, and stakeholders to fortify the foundation upon which JAK stands.

Looking ahead, the future of Jan Aushadhi Kendra holds promise and potential. With continued support, innovation, and strategic expansion, JAK has the capacity to revolutionize the landscape of healthcare delivery in India. Collaboration with the private sector, technological advancements, and community engagement are avenues through which JAK can further enhance its impact and reach.

In essence, Jan Aushadhi Kendra embodies the spirit of inclusivity, equity, and compassion in healthcare. Its journey is a testament to the collective determination to ensure that no individual is left behind in the pursuit of well-being. As we reflect on its achievements and challenges, let us reaffirm our commitment to bolstering Jan Aushadhi Kendra's mission and realize the vision of a healthier, more equitable society for all.

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Central Banking, Climate Change & Finance

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Abstract

Central banks play a crucial role in addressing environmental risks and promoting sustainable finance by aligning financial practices with sustainable development. They have the responsibility to ensure financial and macroeconomic stability, allowing them to address climate-related and environmental risks comprehensively. Through their regulatory oversight of money, credit, and the financial system, central banks have the authority to facilitate the development of green finance models and ensure that environmental and carbon risks are priced appropriately by financial institutions. The focus of this paper is on the public financial governance policies that central banks and relevant financial regulatory agencies can implement to promote sustainable finance. It discusses why central banks should prioritise aligning finance with sustainable development, reviews the tools available to address environmental risks and promote green finance, and briefly outlines green public financial governance initiatives.

Keywords: sustainable development, green finance, bank

Introduction

To achieve the 2030 Agenda for Sustainable Development and the Paris Climate Accord, investment will have to be directed away from carbon- and resource-intensive investments, and toward sustainable investment. Responsibility for financial and macroeconomic stability implicitly or explicitly rests with the central bank, which therefore ought to address climate-related and other environmental risks on a systemic level. Furthermore, central banks, through their regulatory oversight over money, credit, and the financial system, are in a powerful position to support the development of sustainable finance approaches and enforce an adequate pricing of environmental and carbon risk by financial institutions (Volz 2017). Against this backdrop, the paper discusses the extent to which central banks should incorporate environmental considerations into their operations and reviews the public financial governance policies through which central banks, as well as other relevant financial regulatory agencies, can promote green finance.

Here is a breakdown of the key points

- 2**030 Agenda for Sustainable Development and the Paris Climate Accord:** These international agreements set ambitious goals for global sustainability and climate action. Achieving these goals requires shifting investments away from carbon-intensive activities towards sustainable alternatives.

- **Role of Central Banks:** Central banks play a crucial role in ensuring financial and macroeconomic stability. As such, they have a responsibility to address climate-related and other environmental risks at a systemic level.

- **Promoting Sustainable Investment:** Central banks have the power to influence the allocation of investments by directing capital towards sustainable projects and away from environmentally harmful ones.

- **Regulatory Oversight:** Through their regulatory oversight of the financial system, central banks can encourage financial institutions to incorporate environmental considerations into their decision-making processes. This includes assessing and pricing environmental and carbon risks.

- **Public Financial Governance Policies:** The paper discusses how central banks and other financial regulatory agencies can implement policies to promote green finance. This may include setting guidelines for sustainable lending practices, providing incentives for green investments, or implementing environmental stress tests for financial institutions.

Litrature Review

"**Central Banking, Climate Change, and Green Finance" by Dikau and Volz (2021)**

This paper discusses the role of central banks in addressing climate change and promoting green finance. It reviews the tools and instruments available to central banks and financial regulatory agencies to promote green finance and provides examples of public green financial policies in different policy areas. It also argues that an explicit legal mandate is required for central banks to assume an active "greening" role, considering the potentially distributive consequences.

"**Central Banking, Climate Change, and Green Finance" by Dikauu and Volz (2018)**

This paper highlights the role of central banks in supporting the development of green finance models and enforcing adequate pricing of environmental and carbon risk by financial institutions. It also discusses public financial governance policies through which central banks and financial regulatory agencies can address environmental risk and promote sustainable finance.

"**Green Central Banking in Emerging Market and Developing Country Economies" by Dikau and Ryan-Collins (2017)**

This paper explores the potential role of central banks in emerging market and developing country economies in promoting green finance and sustainability objectives. It argues that central banks in these economies have been comparatively more active in promoting green finance and sustainable development.

"**How can green differentiated capital requirements affect climate risks? A dynamic macro financial analysis" by Dafermos and Nikolaidi (2021)**

This paper examines the impact of green differentiated capital requirements on climate risks using a dynamic macro financial analysis. It argues that such requirements can help reduce climate risks and promote sustainable finance.

"**Greening Capital Requirements" by Dafermos, Lerven and Nikolaidi (2022)**

This paper discusses the potential benefits of greening capital requirements for promoting sustainable finance. It argues that such requirements can help reduce climate risks and promote green investment.

"**The Case for Central Bank Independence: A Review of Key Issues in the International Debate" by Dall'Orto Mas et al. (2020)**

This paper reviews the key issues in the international debate on central bank independence. It argues that central bank independence is essential for maintaining price stability and financial stability.

"**Credit Rating Agencies and Sovereign Debt: Four Proposals to Support Achievement of the SDGs" by Siegal, Chowla et al. (2022)**

This paper discusses four proposals to support the achievement of the Sustainable Development Goals (SDGs) by credit rating agencies. It argues that credit rating agencies play a crucial role in promoting sustainable finance and reducing climate risks.

"**Net Zero Transition Plans: A Supervisory Playbook for Prudential Authorities" by Dikau et al. (2022)**

This paper discusses the role of prudential authorities in promoting net zero transition plans for financial institutions. It argues that such plans are essential for reducing climate risks and promoting sustainable finance.

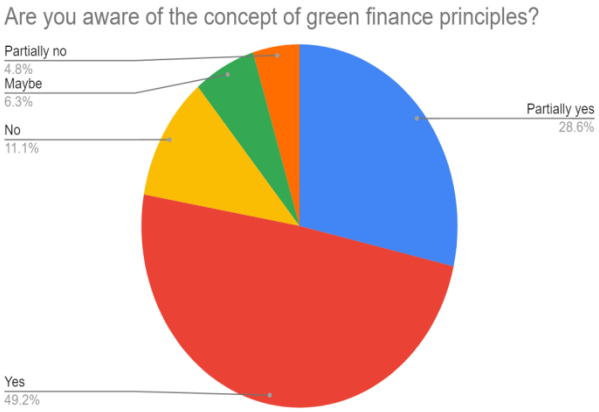
"**Assessing the Effectiveness and Impact of Central Bank and Supervisory Policies in Greening the Financial System across the Asia-Pacific" by Augoyard et al. (2021)**

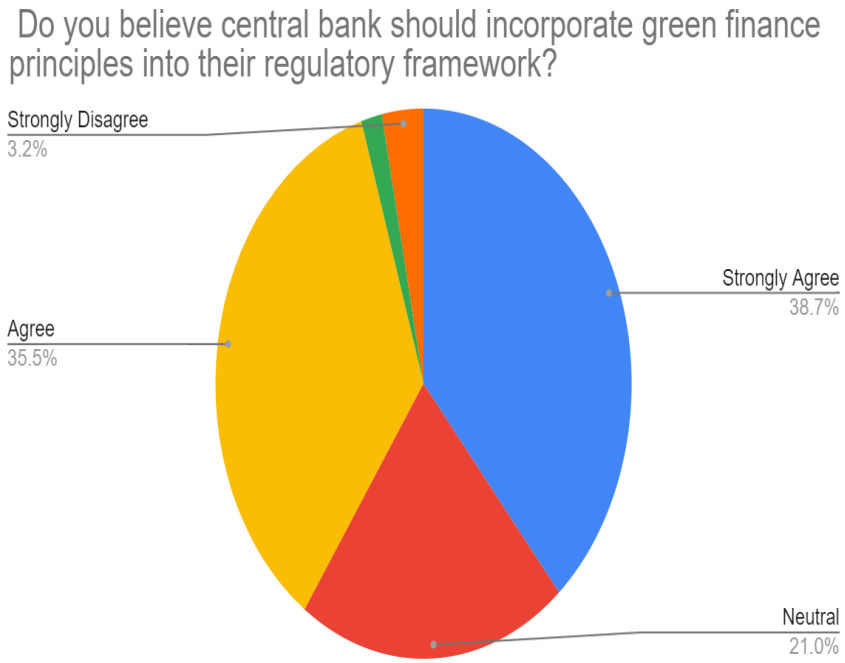
This paper assesses the effectiveness and impact of central bank and supervisory policies in greening the financial system across the Asia-Pacific. It argues that such policies are essential for reducing climate risks and promoting sustainable finance.

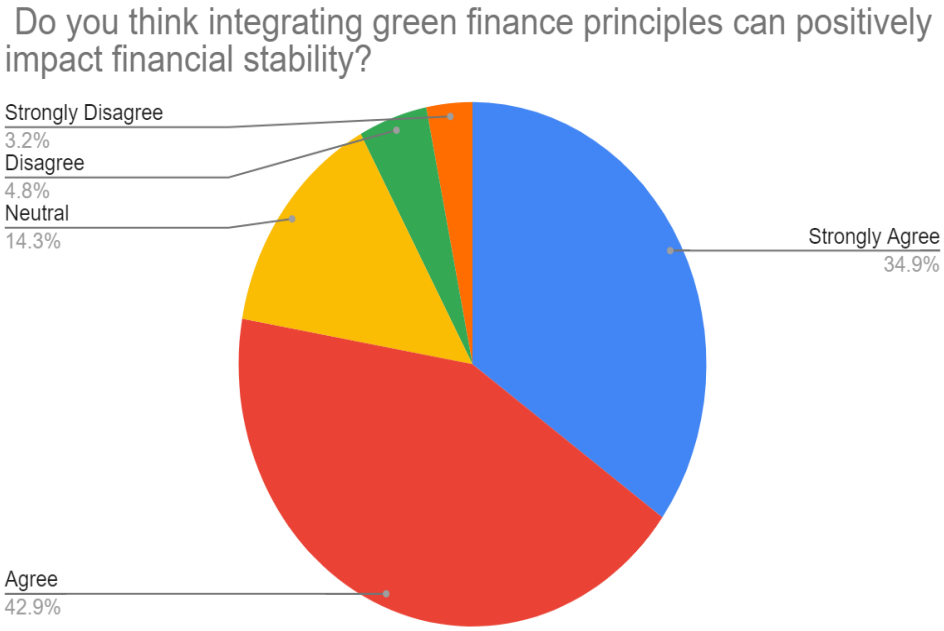
Research Methodology

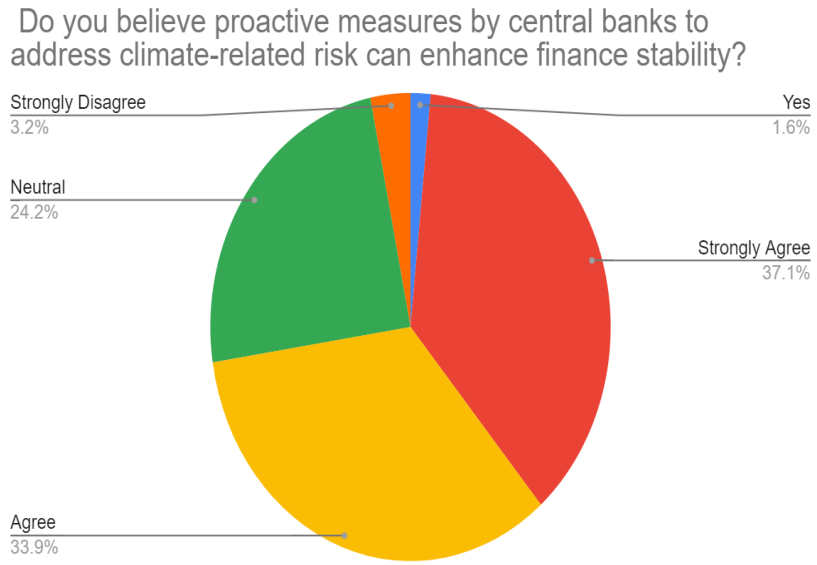
The study involves asking questions to the top level managers of corporations through links to a questionnaire. The responses from the questionnaire were analyzed through pie charts and findings were summed up and analyzed.

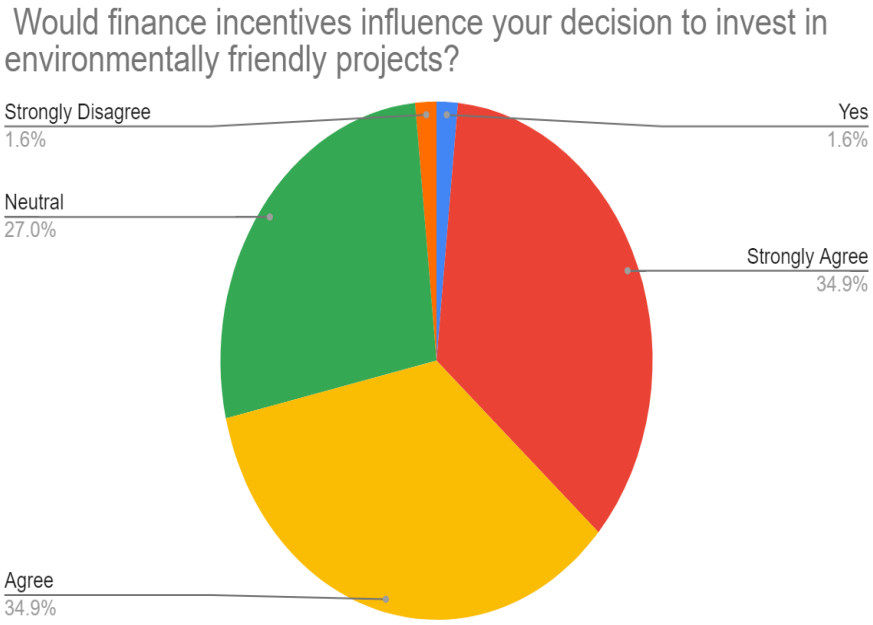
Data Analysis

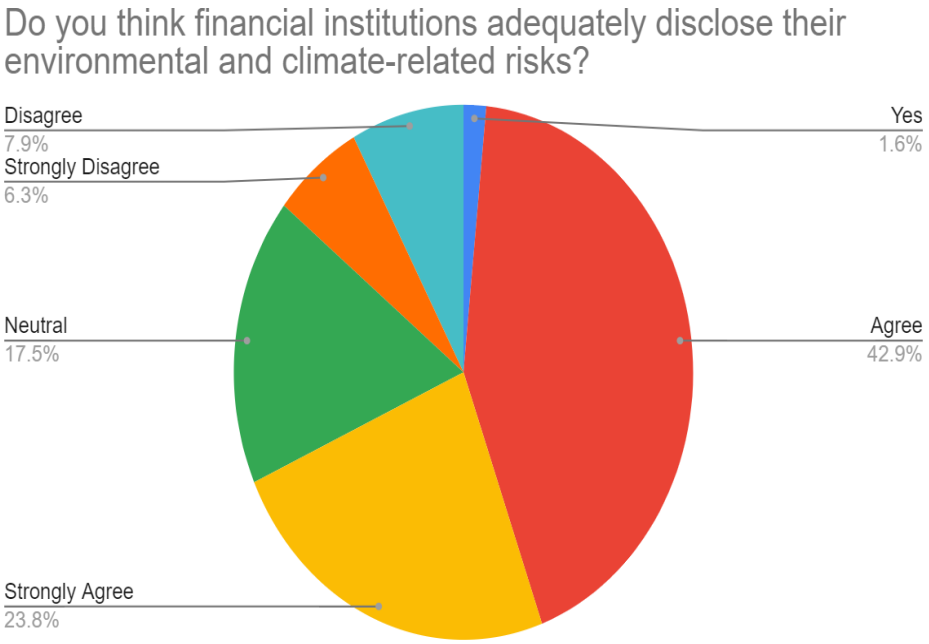


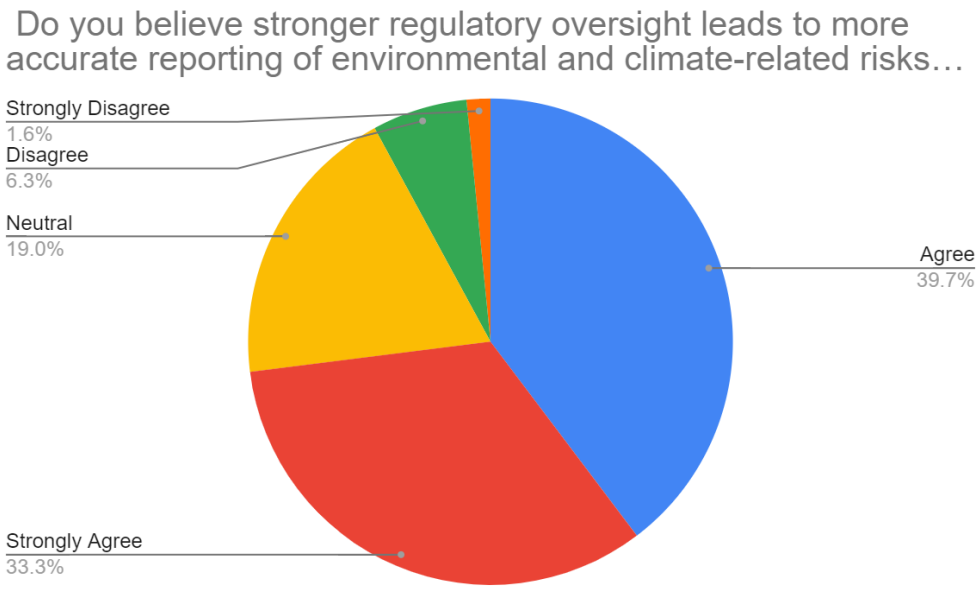

Do you believe central bank should incorporate green finance principles into their regulatory framework?
Strongly Disagree
3.2%
Strongly Agree
38.7%
Agree
35.5%
Neutral
21.0%

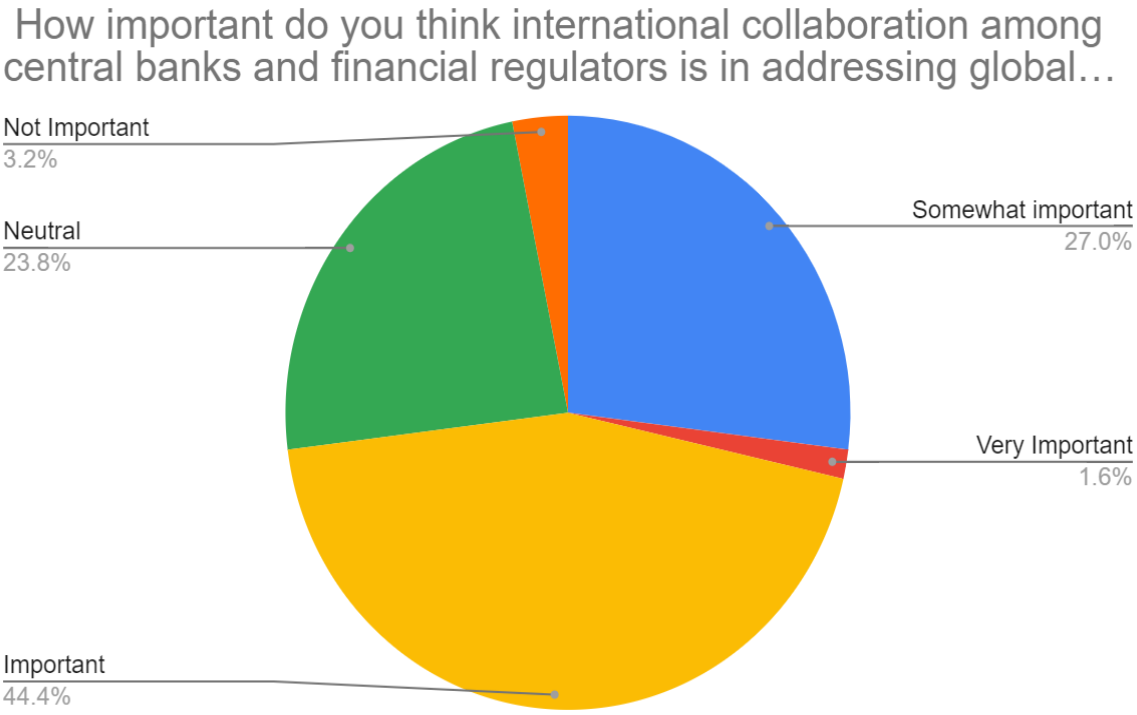

Do you think integrating green finance principles can positively impact financial stability?
Strongly Disagree
3.2%
Disagree
4.8%
Neutral
14.3%
Strongly Agree
34.9%
Agree
42.9%

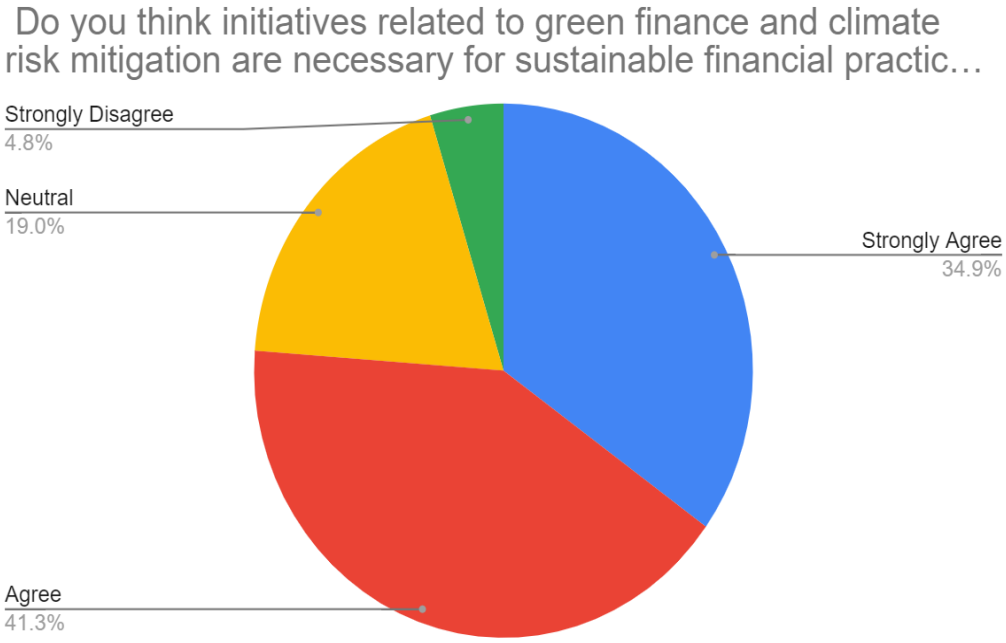

Do you believe proactive measures by central banks to address climate-related risk can enhance finance stability?
Strongly Disagree
3.2%
Yes
1.6%
Neutral
24.2%
Strongly Agree
37.1%
Agree
33.9%


Would finance incentives influence your decision to invest in environmentally friendly projects?
Strongly Disagree
1.6%
Yes
1.6%
Neutral
27.0%
Strongly Agree
34.9%
Agree
34.9%


Do you think financial institutions adequately disclose their environmental and climate-related risks?
Disagree
7.9%
Strongly Disagree
6.3%
Neutral
17.5%
Strongly Agree
23.8%
Yes
1.6%
Agree
42.9%


Do you believe stronger regulatory oversight leads to more accurate reporting of environmental and climate-related risks…
Strongly Disagree
1.6%
Disagree
6.3%
Neutral
19.0%
Strongly Agree
33.3%
Agree
39.7%


How important do you think international collaboration among central banks and financial regulators is in addressing global…
Not Important
3.2%
Neutral
23.8%
Somewhat important
27.0%
Very Important
1.6%
Important
44.4%


Do you think initiatives related to green finance and climate risk mitigation are necessary for sustainable financial practic…
Strongly Disagree
4.8%
Neutral
19.0%
Strongly Agree
34.9%
Agree
41.3%

Findings

- It was revealed that almost 50% of the respondents are aware of the green finance principles.
- More than 70% of the respondents agree that corporate should incorporate green finance principles in their regulatory framework.
- More than 75% of the respondents agree that incorporating green finance principles can positively impact financial stability.
- Almost 70% of the respondents believe that proactive steps taken by central banks to address climate related risks can positively impact financial stability.
- More than 75% of the respondents believe that financial incentives do influence their decision to invest in environmenta friendly projects.
- Almost 65% of respondents believe that financial institutions adequately disclose their environment and climate related risks.
- More than 70% of the respondents believe that a strong regulatory oversight would lead to better reporting of environmental and climate risks.
- Almost 50% of the respondents believe that international collaboration between central banks and financial regulators is effective in tackling sustainability issues.
- More than 75% of the respondents believe that green finance and climate risk mitigation practices are necessary for sustainable financial practices.

Recommendations

- As per government policy initiatives, laws must be made to promote green finance initiatives.
- Central banks should take proactive steps in addressing climate change risks.
- Government policies should provide financial incentives to increase investment in environmenta friendly projects.
- A strong regulatory oversight should be created to lead to better reporting of overall sustainability risks.
- Central Banks and Financial Institutions should work for more international collaborations.

Conclusion

The research papers and feedback from respondents also emphasize the importance of central banks' collaboration with other stakeholders to promote green finance and sustainable development. Central banks can collaborate with international organizations, such as the Bank for International Settlements

(BIS), the Network for Greening the Financial System (NGFS), and the International Monetary Fund (IMF), to share best practices and promote sustainability measures.

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Identifying the Antecedents of Layoffs and its Impact on the Organizational Workplace and Employee Wellbeing

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Abstract

The study delves into the repercussions of layoffs on employee attitudes and job performance within the IT sector. It acknowledges the necessity of layoffs for financially strained organizations but highlights the adverse perception they generate among employees. Through analyzing a sample of 50 participants, the research aims to comprehend the impact of layoffs on job satisfaction and employees' viewpoints. Findings indicate that layoffs are often seen as a management shortfall, leading to a breakdown in trust between employees and organizational leadership. Suggestions from employees include enhancing transparency, communication, and support during layoffs to mitigate these issues. The study underscores a notable surge in layoffs, particularly in major tech firms, catalyzed by the COVID-19 pandemic. It emphasizes the need for organizations to recognize layoffs as management failures and prioritize trust in leadership. Furthermore, it advocates for practical steps to enhance the layoff process, fostering mutual benefits. The paper calls for further investigation in this domain and proposes precautionary measures for organizations to alleviate the negative repercussions of layoffs on their workforce (Abinaya & Veena, 2023).

Keywords: Employee, performance, pandemic, management

Introduction

The information technology (IT) sector is well-known for its dynamic nature, characterized by rapid technological advancements and evolving corporate objectives. To maintain competitiveness and adaptability, layoffs have become a common practice in the industry. While layoffs may be necessary for financial stability, they can significantly impact the individuals affected.

Despite the prevalence of layoffs in the IT sector, there is limited understanding of how employees perceive and experience this practice. This study aims to address this gap by exploring the opinions of IT workers on layoffs, focusing on the financial, social, and emotional consequences for the individuals involved.

Utilizing a mixed-methods approach, the research combines surveys and in-depth interviews with a diverse group of IT workers who have undergone layoffs. By analyzing their narratives and perspectives, the study aims to illuminate the subjective experiences of laid-off IT personnel and their perceptions of the practice. The structure of the study involves an overview of existing research on layoffs in the IT sector, followed by the presentation of research methodology and sample characteristics. The findings discuss how layoffs impact IT workers' emotional, social, and financial well-being, along with their perceptions of the practice. The study concludes with recommendations for further research and practical applications.

This research holds significance as it provides valuable insights into the experiences of laid-off IT workers. This information can contribute to the development of more ethical and compassionate workforce reduction methods within the IT industry.

Literature Review

This study proposes a framework for delivering layoff announcements based on literature review and analysis of eight companies. It offers ten recommendations, emphasizing the need for a comprehensive strategy. Factors such as organizational dynamics, layoff nature, news source, delivery medium, timing, and message content are vital considerations (Smeltzer & Zener, 2008). The scrutiny of workforce downsizing is increasingly vital given its widespread use. This article introduces a comprehensive framework considering organizational, environmental factors, and downsizing's impact on individuals and organizations. It discusses critical patterns and contradictions in empirical studies, analyzing theoretical and methodological issues in existing literature and proposing future research directions for better comprehension (Datta, 2010).

Organizations employ downsizing to boost efficiency and reduce expenses, yet it frequently leads to employee dissatisfaction. This study explores how downsizing affects the job and life satisfaction of those remaining after layoffs. Drawing from two prominent Pakistani organizations, the study includes 450 participants with a 75% response rate. Results indicate downsizing negatively impacts the satisfaction of survivors. Furthermore, it evaluates and contrasts satisfaction levels between the two organizations. These findings are analyzed alongside existing literature, offering insights for researchers, academics, and policymakers into the ramifications of downsizing on job and life satisfaction (Malik et al., 2010).

This study investigated how extensive staff reductions affect remaining employees, focusing on the relationship between layoffs and work behaviors. It hypothesized that layoffs would harm performance and Organizational Citizenship Behaviors (OCB), due to job insecurity and contract breaches, but perceived management support could mitigate these effects. Conducted through a survey of 615 employees from diverse Chilean organizations, our research, utilizing the psychological contract framework, enhances understanding of how mass layoffs influence workplace behavior (López Bohle, 2017).

In 2013, significant layoffs impacted millions of Americans, leading to employee resentment and the potential for retaliatory lawsuits. Today, profitable businesses continue restructuring and layoffs, negatively affecting employees, management, and those who remain employed. This study aimed to investigate the effects of layoffs and downsizing on employee trust, job performance, behavior, and health. Guided by Sarker's theory on management and employee trust, the research questions explored participants' work attitudes and performance post-layoffs. Semi-structured interviews involved twenty participants, comprising both managers and individuals who had been laid off or survived layoffs (Carrington, 2016).

This study explored the determinants influencing how survivors coped with a recent workforce reduction, involving permanent layoffs. The participant pool comprised 200 unionized telecom technicians. Findings indicated that survivors with higher levels of optimism and a strong sense of mastery were more inclined to engage in control-oriented coping mechanisms. The perceived threat of job loss was associated with the utilization of both control and escape coping, while powerlessness correlated with the use of control coping. Control coping demonstrated a connection to positive outcomes, whereas escape coping showed associations with negative outcomes. Coping strategies impacted outcome variables in both additive and interacting manners. The management implications of these findings are highlighted. (Armstrong- Stassen, (2010)).

Conceptual Model

The model outlines how layoffs impact employees' psychological and financial well-being. It shows that layoffs can cause psychological distress, including insecurity and anxiety, leading to decreased motivation and productivity. Financially, layoffs can reduce labor costs initially but may incur costs for severance, recruitment, and training. Long-term effects include the loss of human capital and skills, affecting organizational performance.

Methodology

Objectives of the Study

- To examine the factors influencing the impact of layoffs on the IT industry.
- To analyze the transformations occurring in the IT sector as a result of layoffs.
- To explore the organizational practices surrounding layoffs in the IT sector and their implications for employee well-being.

Research Design

This study adopts a descriptive research approach to explore the ramifications of layoffs on employee attitudes and job performance within the IT industry. It aims to intricately describe these effects, focusing on perceptions, job satisfaction, and future career prospects, while also examining how organizational practices surrounding layoffs influence employee well-being. The research employs a quantitative methodology, utilizing surveys to gather data from IT employees who have encountered layoffs. The survey encompasses various dimensions, including perceptions of the layoff process, workload changes, job satisfaction, future career outlooks, trust in the organization, psychological well-being, and social support. Respondents are chosen through the snowball sampling method, leveraging initial participants to refer others who have undergone layoffs, facilitating access to typically challenging-to-reach groups. Statistical analysis and data visualization techniques will be applied to analyze the collected data comprehensively. The study's outcomes aim to provide profound insights into the impact of layoffs on IT employees, offering recommendations for organizations to effectively support employees during such circumstances.

Data Collection

The study collected data from 70 respondents within the IT sector, including both recently laid-off employees and those still working in the organization. Respondents were selected using a non-probability judgmental sampling method, focusing on individuals from organizations that had recently conducted layoffs. Fifty respondents were selected for analysis after excluding those with plagiarized or biased responses. Data collection took place from November 2023 to February 2024. The survey questionnaire covered various topics related to the respondents' experiences with layoffs, including their perception of the layoff process, changes in workload post-layoff, job

satisfaction, future career prospects, and trust in the organization, psychological well-being, and social support. Demographic information was also collected. The study aimed to explore the impact of layoffs on the psychological and financial well-being of IT sector employees. By including laid-off employees, the study sought to gain a comprehensive understanding of how layoffs affect individuals in the IT industry and how organizations can better support their employees during such challenging times.

Correlation between layoff and psychological factors – Stress and Anxiety

Concern about being laid off	-0.5
Increased workload due to layoffs	0.0
Feeling secure in current job position	-1.0
Tense working environment due to layoffs	0.5
Clear and transparent communication from manage…	0.866025
Belief that layoffs were necessary for company'…	NaN
Fair and unbiased selection process for layoffs	0.0
Negative effect of layoffs on morale and motiva…	-0.866025
Consideration of looking for a new job due to i…	0.866025
Adequate support for laid-off employees	-0.866025

Balance of work and personal life

Concern about being laid off	-0.866025
Increased workload due to layoffs	-0.5
Feeling secure in current job position	-0.866025
Tense working environment due to layoffs	0.866025
Clear and transparent communication from manage...	1.0
Belief that layoffs were necessary for company'...	NaN
Fair and unbiased selection process for layoffs	-0.5
Negative effect of layoffs on morale and motiva...	-1.0
Consideration of looking for a new job due to i...	1.0
Adequate support for laid-off employees	-1.0

Feeling valued and appreciated at work

Concern about being laid off	-0.5
Increased workload due to layoffs	0.0
Feeling secure in current job position	-1.0
Tense working environment due to layoffs	0.5
Clear and transparent communication from manage...	0.866025
Belief that layoffs were necessary for company'...	NaN
Fair and unbiased selection process for layoffs	0.0
Negative effect of layoffs on morale and motiva...	-0.866025
Consideration of looking for a new job due to i...	0.866025
Adequate support for laid-off employees	-0.866025

Negative impact of uncertainty at work on mental health

Concern about being laid off	-0.5
Increased workload due to layoffs	0.0
Feeling secure in current job position	-1.0
Tense working environment due to layoffs	0.5
Clear and transparent communication from manage...	0.866025
Belief that layoffs were necessary for company'...	NaN
Fair and unbiased selection process for layoffs	0.0
Negative effect of layoffs on morale and motiva...	-0.866025
Consideration of looking for a new job due to i...	0.866025
Adequate support for laid-off employees	-0.866025

Availability of someone at work to talk to about concerns

Concern about being laid off	0.5
Increased workload due to layoffs	0.0
Feeling secure in current job position	1.0
Tense working environment due to layoffs	-0.5
Clear and transparent communication from manage...	-0.866025
Belief that layoffs were necessary for company'...	NaN
Fair and unbiased selection process for layoffs	0.0
Negative effect of layoffs on morale and motiva...	0.866025
Consideration of looking for a new job due to i...	-0.866025
Adequate support for laid-off employees	0.866025

Experience of burnout in recent weeks

Concern about being laid off	0.944911
Increased workload due to layoffs	0.981981
Feeling secure in current job position	0.188982
Tense working environment due to layoffs	-0.944911
Clear and transparent communication from manage...	-0.654654
Belief that layoffs were necessary for company’...	NaN
Fair and unbiased selection process for layoffs	0.981981
Negative effect of layoffs on morale and motiva...	0.654654
Consideration of looking for a new job due to i...	-0.654654
Adequate support for laid-off employees	0.654654

Access to mental health resources provided by company

Concern about being laid off	0.5
Increased workload due to layoffs	0.866025
Feeling secure in current job position	-0.5
Tense working environment due to layoffs	-0.5
Clear and transparent communication from manage...	0.0
Belief that layoffs were necessary for company’...	NaN
Fair and unbiased selection process for layoffs	0.866025
Negative effect of layoffs on morale and motivation	0.0
Consideration of looking for a new job due to i...	0.0
Adequate support for laid-off employees	0.0

Confidence in ability to handle work-related stress and anxiety

Concern about being laid off	-0.5
Increased workload due to layoffs	0.0
Feeling secure in current job position	-1.0
Tense working environment due to layoffs	0.5
Clear and transparent communication from manage...	0.866025
Belief that layoffs were necessary for company’...	NaN
Fair and unbiased selection process for layoffs	0.0
Negative effect of layoffs on morale and motiva...	-0.866025
Consideration of looking for a new job due to i...	0.866025
Adequate support for laid-off employees	-0.866025

These results suggest that factors related to job security, workload, communication, and support systems play significant roles in influencing employees' mental health, work-life balance, and overall job satisfaction during periods of layoffs and uncertainty in the workplace.

Correlation between layoff and financial factors –

Consideration or uptake of additional employment

Concern about being laid off	-0.866025
Increased workload due to layoffs	-1.0
Feeling secure in current job position	0.0
Tense working environment due to layoffs	0.866025
Clear and transparent communication from manage...	0.5
Belief that layoffs were necessary for company’...	NaN
Fair and unbiased selection process for layoffs	-1.0
Negative effect of layoffs on morale and motiva...	-0.5
Consideration of looking for a new job due to i...	0.5
Adequate support for laid-off employees	-0.5

Satisfaction with current compensation

Concern about being laid off	-0.866025
Increased workload due to layoffs	-0.5
Feeling secure in current job position	-0.866025
Tense working environment due to layoffs	0.866025
Clear and transparent communication from manage...	1.0
Belief that layoffs were necessary for company’...	NaN
Fair and unbiased selection process for layoffs	-0.5
Negative effect of layoffs on morale and motivation	-1.0
Consideration of looking for a new job due to income	1.0
Adequate support for laid-off employees	-1.0

Reassessment and adjustment of financial plans and goals

Concern about being laid off	0.0
Increased workload due to layoffs	0.5
Feeling secure in current job position	-0.866025
Tense working environment due to layoffs	0.0
Clear and transparent communication from manage...	0.5
Belief that layoffs were necessary for company’...	NaN
Fair and unbiased selection process for layoffs	0.5
Negative effect of layoffs on morale and motivation..	-0.5
Consideration of looking for a new job due to income...	0.5
Adequate support for laid-off employees	-0.5

Feeling financially prepared for potential unemployment

Concern about being laid off	-1.0
Increased workload due to layoffs	-0.866025
Feeling secure in current job position	-0.5
Tense working environment due to layoffs	1.0
Clear and transparent communication from manage...	0.866025
Belief that layoffs were necessary for company'...	NaN
Fair and unbiased selection process for layoffs	-0.866025
Negative effect of layoffs on morale and motiva...	-0.866025
Consideration of looking for a new job due to i...	0.866025
Adequate support for laid-off employees	-0.866025

Clear and transparent communication from management doesn't seem to significantly impact financial factors. A fair and unbiased selection process for layoffs is linked to employees reassessing and adjusting their financial plans and goals. The negative effect of layoffs on morale and motivation doesn't show a strong correlation with financial factors. Considering or taking up additional employment is associated with lower satisfaction with current compensation. Adequate support for laid-off employees doesn't appear to directly impact other employees' financial perceptions.

Conclusion

Research on IT sector layoffs reveals profound impacts on workplace dynamics and employee well-being, including insecurity, anxiety, and decreased job satisfaction. Clear communication from management is crucial but insufficient without robust support measures. Financial factors like compensation satisfaction and preparedness for unemployment are also significantly affected. Organizations must approach layoffs with sensitivity, transparency, and comprehensive support to mitigate adverse effects. Further research is needed to refine strategies for managing layoffs and supporting employees effectively.

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A Study on Sabbaticals Preferences to Support Professional Growth and Well-Being

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Abstract

Sabbaticals have emerged as a vital tool for professionals seeking to enhance their career trajectories while prioritising personal well-being. This paper explores the multifaceted benefits of sabbaticals and proposes a strategic framework for leveraging this time effectively. Firstly, the paper examines the evolving landscape of work-life balance and the increasing recognition of sabbaticals as a means to rejuvenate, recharge, and refocus. It delves into the psychological, emotional, and physical benefits that sabbaticals offer, including reduced stress, enhanced creativity, and improved overall health. Furthermore, the paper explores the importance of intentionality and goal-setting in maximizing the benefits of a sabbatical. It emphasizes the need for individuals to align their sabbatical plans with their long-term career aspirations and personal values, ensuring a purposeful and fulfilling experience. The paper has used qualitative methodology to get insights from 40 respondents belonging to different industries. The research concluded that people tend to take sabbatical for career growth and well-being.

Introduction

Sabbatical leave is a break from work, allowing employees to pursue interests such as travelling, writing, research, or volunteering. During this period, employees remain part of their organisation but are exempt from regular duties. Common in educational institutions, sabbaticals can also be found in corporations. Sabbaticals have emerged as a valuable tool for personal and professional development, offering individuals and organizations a range of benefits. This research paper explores the multifaceted advantages of sabbaticals, including personal renewal, professional growth, enhanced creativity and innovation, improved work-life balance, increased job satisfaction, and retention rates. Additionally, it delves into the necessary considerations and planning required for a successful sabbatical experience, emphasizing the importance of open communication between employees and employers, clarification of expectations, and strategic utilization of time away from work.

Literature Review

Spacht (2018) undertook a research project focusing on **sabbatical structures, outcomes, and impacts within nonprofit organisations.** One observation highlighted by a participant was the tendency for individuals to gravitate towards the for-profit sector due to the significantly higher financial rewards compared to the nonprofit sector. The study suggests that exploring the structure of sabbaticals, including whether they are paid, unpaid, or partially paid, within nonprofit organisations could be a potential avenue for further investigation. Understanding the impact of sabbatical policies on job satisfaction and employee retention in the nonprofit sector is crucial for enhancing organisational effectiveness and employee well-being.

Dinsmore (2021) conducted a quantitative study to evaluate how Human Resources (HR) professionals perceive **non-academic workplace sabbaticals.** The research involved administering an electronic survey to senior-level employees. The study highlighted the varying approaches to sabbaticals in non-academic workplaces. Paid sabbaticals, which encompass partial or full salaries, typically last for 4 to 6 months. In contrast, unpaid sabbaticals, although offered, are often perceived as less beneficial to employees as they resemble regular vacations for personal endeavours. However, essential benefits such as medical insurance and retirement perks are typically maintained during unpaid sabbaticals, similar to paid leaves, for a specified period. The analysis underscores the importance of considering paid, unpaid, and partially paid sabbaticals as retention benefits. Moreover, the study suggests that the costs to the organisation can vary dramatically based on the type of sabbatical offered. Understanding these differences is crucial for HR professionals in designing effective sabbatical policies that align with organisational goals while meeting the needs of employees

Leung, Barreto, and Nelson (2020) conducted a systematic review aimed at synthesising a qualitative and evidence-based summary regarding **sabbaticals for health-system pharmacists.** The literature search process recovered 328 articles, with an additional 13 potential articles identified through reference review. After removing duplicates and non-English records, 321 full-text articles were screened for eligibility, resulting in the inclusion of 172 publications in the systematic review. In an era marked by increased scrutiny on resource utilisation, there is a growing interest in evidence that justifies the impact of sabbaticals for health-system pharmacists.

Bass, Caldwell, Cao, and Lee (2021) focused on **Planning the Sabbatical: Potential Benefits, Options, and Strategies** by exploring the varied structures and durations of administrative sabbaticals, highlighting

individual benefits such as professional development and organisational impacts on innovation. The research revealed a lack of sufficient knowledge about sabbaticals among mid-career professionals, underscoring the need for guidance in this area. To address this knowledge gap, the Mid-career Professional Group developed a multifaceted support approach. This approach incorporates elements such as literature review, surveys, interviews, case studies, and expert consultation, with the aim of enhancing professionals' understanding and execution of sabbaticals for personal and professional development.

Schabram, Bloom, and DiDonna (2023) interviewed 50 individuals from various private, public, and non-profit organizations to explore the **transformative nature of sabbaticals**. The researchers delved deeply into the experiences of these individuals before, during, and after their sabbaticals to understand what made their time away so impactful. The findings of the study indicate that sabbatical-takers largely returned to their former jobs but with newfound confidence in shaping their work to better fit their needs. Many participants reported experiencing a sense of independence and pursued new projects, arrangements, positions.

Research Gap

Researchers found dearth of research in India on sabbatical for professional growth and well-being in both public and private sector.

- Previous research has found that long leaves are only subject for medical emergencies or maternity leaves.
- In India, there is very little research on companies providing sabbaticals. People here don't often demand for sabbatical due to financial pressure, job risk.
- There is very little research on the people who take long term sabbatical leaves for more than a year and if they tend to join the organisation after such a long break from work.
- Research also doesn't clarify if people are being paid during the sabbatical period or after it, keeping in mind the loyalty of employees towards their respective organisation.

Research Objectives

- To study whether people tend to take sabbaticals for reasons like career growth, well- being and recreational activities.
- To study about the kind of organizations considering the need for sabbatical.

- To study the profit ratio of the organization and an employee in terms of a sabbatical
- To study whether there is job security or if the employees are paid during their sabbaticals period.
- To study about HR's involvement when an employee is being provided sabbatical.

Research Methodology

- We have used **Qualitative** approach for this research paper and we prepared a **structured questionnaire** to take survey from employed people.
  - People having experience of more than 2-3 years.
  - People from various industries.
  - People from every sector (private/public)

We were able to collect around 40 valid responses so far. And got varied responses which helped in the research.

Face Validity

The questionnaire was finalised on the basis of the Face validity we conducted. We made a google form and conducted the interview.

We used the Likert Scale for our data collection. The table below consists of the average relevance of each question.

This table consists of the data taken from 5 experts. And the Likert scale used here works like:

- The question which is Most Relevant is marked as 5 on the scale.
- The question which is Relevant is marked as 4 on the scale.
- The question which is Somewhat Relevant is marked as 3 on the scale.
- The question which is **Not Relevant** is marked as 2 on the scale.

Then, we have taken the average relevance of each question. The table is shown on the next page:

Table 1: Face Validity

Questions	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Average Score
Purposes needed for sabbatical?	5	4	4	4	3	4
Reason for company providing sabbatical?	4	4	4	4	4	4
Any specific conditions according to HR?	4	4	3	5	3	3.8
Career affected by sabbaticals?	4	3	3	4	5	3.8
Benefits from Sabbaticals?	5	4	3	5	4	4.2
Sabbatical provided by Indian organisation?	3	3	4	3	4	3.4
Sector providing sabbatical?	3	3	3	2	3	2.8
Benefits for organisation?	5	3	3	3	4	3.6
Benefitted in what ways?	4	4	3	4	3	3.6
More benefits by whom?	5	3	3	5	4	4
Job Security?	5	5	4	4	3	4.2
Paid/Unpaid?	4	4	2	3	3	3.2
If paid, gross/basic pay?	4	4	2	5	4	3.8
Conditions required for a sabbatical?	4	4	2	3	2	3

As we have received the average score on each question 3 or more than 3. Thus, this validates each item of the questionnaire.

Face Validity: A Critical but Ignored Component of Scale Construction in Psychological Assessment May 2023European Journal of Psychological Assessment 39(3):153-156

Demographics

Age

S No.	Age	No. of people	Percentage
1	18-25 years	20	50%
2	26-40 years	16	40%
3	41 and above	4	10%

Gender

Gender	No. of males	Percentage	No. of females	Percentage
1	22	55%	18	45%

Organization

S No.	Organization	No. of people	Percentage
1	Private	32	80%
2	Public	6	15%
3	Government	2	5%

Industry

S No.	Industry	No. of people	Percentage
1	Finance	12	30%
2	Banking	2	5%
3	IT	13	32.5%
4	Education	11	27.5%
5	Medical	2	5%

Job Experience

S No.	Job Experience	No. of people	Percentage
1	2-3 years	19	47.5%
2	More than 5 years	21	52.5

S No.	Theme	Codes	Description
1	**Wellness Enhancement**	Career Advancement, Health Conditions, Travel, Desire for personal Development	Every age group has chosen career advancement as a purpose to take sabbatical. People above the age of 30 have chosen health conditions to take sabbatical. Young people around the age of 25 preferred travel as their reason to take sabbatical Young generation has taken the desire for personal development as their purpose for taking sabbatical.
2	**Overall Enrichment**	Recreational Activities, Career Growth, Well-Being	The age group between 20-35 has chosen recreational activities. Career growth is the most common reason chosen by most of the people of every age group. Everyone prefers well-being as the reason their companies give them sabbatical.
3	**Career Advancement**	Promotions, Personal Growth, Increments	Mostly people see promotions as as reason for an impact on their career. Most of the people see personal growth as a factor which has a good impact on their career. Increments is less chosen by the people.
4	**Recreational Actualization**	Self -Actualisation, More Family Time, fulfilling personal goals	Age group of 25-40 thinks self actualisation is one of the benefits of taking a sabbatical. More Family time is chosen by every age group as everyone likes to spend time with their families. This is the most common benefit of taking a sabbatical for every age group.
5	**Positive Workplace Environment**	Happy Workplace, Long term retention of an employee, Reduced employee turnover	Young and middle age group people prefer happy workplace as a benefit to their organisation. Long-term retention of an employee serves as a good benefit for the organisation. More satisfied employees and reduced employee turnover is a benefit to the organisation as most people chose this.

6	**Excellence**	Good Performance, Loyalty t o w a r d s t h e o r g a n i s a t i o n , experience	People of all age group think good performance, loyalty and experience as a good reason for which company should provide sabbatical..
7	**Sabbatical Compensation Package**	Paid, unpaid, gross pay, basic pay	These factors depend as per the organisation in which people of any age group work in.

Data Analysis

Findings

We conducted a survey from 40 people and we found out that the majority of the people find career advancement as a good reason for taking a sabbatical. 25% people would like to travel if they get a sabbatical. Around 20% people want to take sabbatical for Personal Development and 18% for their health conditions. Most of the companies provide sabbatical for career growth. 31.8% of people think that companies should provide sabbatical for well-being. 15.9% think their company will provide sabbatical for recreational activities. People have voted the most for fulfilling personal goals and self-actualisation as a benefit of sabbatical. 20% people think that family time is a good benefit if they take a sabbatical. Majority of the Indian organisations provide sabbatical. Every sector provides sabbatical. People are not sure if companies get benefits when their employees get sabbatical. 34.1% people think that the employees being satisfied are a great benefit for the organisation. 27.3% believe in a happy workplace and the rest find long term retention of an employee as a benefit for the organisation. People think both the organisation and the employees get benefitted up to some extent. Most of the people think there is job security in their organisations. 56% organizations provide paid sabbaticals on basic pay. Loyalty towards the organisation is the most basic condition which needs to be fulfilled to get a sabbatical. 20% think completion of a task, 18% good performance and the rest think punctuality and experience as the conditions to be fulfilled to get a sabbatical.

Discussion

This research paper has found that in this emerging era, where people are in a hustle-bustle of everything, they require a break from their hectic work life at some point of their life. Previous papers also suggest that sabbaticals is a need for every industry like education, finance, IT etc. Experiences of people before and after taking the sabbatical are also in the papers published till date. The paper focuses on career advancement as a reason for taking sabbatical. People also prefer travelling when they tend to take sabbatical. The

organisations also give sabbatical for the same reasons like career growth and well-being. There are various rules according to the HR policies one needs to follow to get a sabbatical. Sabbatical affects the career by influencing the personal growth mainly which serves as a good factor. The benefit of taking a sabbatical is recreational actualisation. Not all Indian Organisation provide sabbaticals but most of which do provide paid sabbaticals as basic pay. There are less organisations which provide unpaid sabbaticals, these organisations are termed as non-profit organisations. Both the organisation and employee gets equally benefitted. Healthy Work-place environment is one of the key benefits that organisation get when their employees return after a sabbatical leave. There is job security in the organisation if they have a loyal staff. A good experienced employee who has maintained a decent record in the organisation is considered while providing a sabbatical. Married and unmarried people both want to take sabbatical. This paper concludes that sabbatical is a need in this busy world where people need to take a small break to relax and spend time with their families and for their carer advancement and up-skilling.

Limitations

A limitation of the research lies in its small sample size, despite its focus on the expansive Delhi- NCR area. This diminutive sample may restrict the extent to which findings can be extrapolated to the broader population of the region, potentially compromising the study's overall generalizability.

Future Scope

One limitation of the research is its restricted scope, as it currently focuses solely on the Delhi-NCR area. While the study could benefit from expanding its reach to encompass a broader geographical range, such as across all of India, this expansion may pose logistical challenges and require additional resources. Moreover, incorporating respondents from a wider geographical area could introduce variability in factors such as demographics and cultural nuances, potentially complicating data analysis and interpretation.

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Students' Entrepreneurial Orientation and Plans of Setting Business

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Abstract

This study explores students' entrepreneurial orientation and their aspirations for starting businesses. Entrepreneurial orientation includes attributes like creativity, initiative, risk-taking, autonomy, and competitive drive. Understanding students' entrepreneurial tendencies and business intentions is crucial for fostering an environment conducive to entrepreneurship and innovation. The research employs both quantitative and qualitative methods, including surveys and interviews with undergraduate students from diverse disciplines. Findings reveal variations in entrepreneurial orientation influenced by educational exposure, prior experiences, and socio-cultural factors. The study highlights the role of entrepreneurship education in shaping students' mindsets and driving entrepreneurial pursuits, offering insights for educators, policymakers, and support entities to nurture entrepreneurial zeal.

Keywords: Entrepreneur, student, innovation, policy

Introduction

Entrepreneurship

Entrepreneurship traces its roots back to the French language, with the term 'Entrepreneur' coined by economist Jean-Baptiste Say in the early 19th century. Initially denoted as an "adventurer," Say emphasized the role of entrepreneurs in reallocating economic resources from lower to higher production areas, yielding greater returns. The dictionary definition describes an entrepreneur as someone who undertakes ventures, often serving as the intermediary between capital and labor. The essence of entrepreneurship encompasses a unique skill set possessed by individuals venturing into business endeavors. These individuals exhibit a propensity for risk-taking that surpasses conventional bounds, coupled with a relentless pursuit of wealth creation. Entrepreneurs navigate through obstacles inherent in their chosen industries, propelled by a vision and strategy while others opt for the security of traditional employment. Successful entrepreneurship often hinges on seizing opportunities,

even amidst uncertainty and risk. Opportunistic individuals adeptly identify and capitalize on favorable circumstances, demonstrating resilience and tenacity in pursuing their goals. Entrepreneurship transcends mere economic activity; it embodies innovation, creativity, and a drive for societal impact.

Entrepreneurial Orientation (EO)

Entrepreneurial orientation (EO) stands as a multifaceted construct that underpins the ethos of entrepreneurship within organizations and individuals alike. In today's dynamic business landscape, EO is increasingly recognized as a critical determinant of organizational success and longevity. Firms exhibiting a strong EO are better equipped to navigate through uncertainties, capitalize on emerging opportunities, and sustain competitive advantage over time. This orientation fosters a culture of agility and adaptability, enabling organizations to swiftly respond to market shifts and technological disruptions. Furthermore, EO serves as a catalyst for innovation, fostering a culture of experimentation and continuous improvement within organizations. By encouraging employees to think creatively and explore novel solutions to existing challenges, EO fuels the engine of innovation, driving long-term growth and prosperity.

In essence, entrepreneurial orientation transcends organizational boundaries, permeating through diverse sectors and domains. Its significance lies not only in driving individual success and organizational performance but also in fostering societal progress and sustainable development. As we navigate through an era of unprecedented change and disruption, cultivating and nurturing entrepreneurial orientation emerges as a critical imperative for organizations and societies alike, heralding a future characterized by resilience, innovation, and prosperity.

Dimensions of Entrepreneurial Orientation

The Entrepreneurial Orientation framework provides a comprehensive lens through which to understand the multifaceted nature of entrepreneurial behavior. Each dimension contributes uniquely to the entrepreneurial mindset, underscoring the importance of traits such as self-confidence, opportunity recognition, risk-taking propensity, and determination in driving entrepreneurial success.

Review of Literature

One of the central dimensions explored in studies on EO is risk-taking behavior, a fundamental aspect of entrepreneurial ventures. Entrepreneurial

students often exhibit a heightened willingness to embrace risks compared to their non-entrepreneurial counterparts. This inclination towards risk-taking is influenced by a myriad of factors, including access to information, subjective norms within their social and professional networks, and the prevailing environment. Workplace spirituality and entrepreneurship education emerge as pivotal factors in shaping entrepreneurial intention and orientation, illustrating the significance of both internal and external influences in fostering an entrepreneurial mindset.

Moreover, gender disparities and variations across academic disciplines play a significant role in shaping entrepreneurial orientation. Studies indicate that males and individuals in certain fields such as technology, engineering, and design demonstrate a stronger inclination towards entrepreneurship, reflecting disparities in interest and perseverance across demographic groups. Additionally, psychological factors such as self-esteem and self-efficacy emerge as strong determinants of individual entrepreneurial orientation, highlighting the importance of personal attributes in driving entrepreneurial behavior.

Further insights into the entrepreneurial mindset and intentions of university students are gleaned through research conducted in various academic settings. For example, studies conducted at research universities in Malaysia, India, and Nigeria shed light on the role of EO in driving research commercialization, shaping entrepreneurial intentions, and fostering skill development among students. Comparative studies across genders and family backgrounds offer valuable insights into the influence of diverse academic backgrounds on entrepreneurial aspirations, emphasizing the need for tailored approaches to entrepreneurship education and support.

- **Innovativeness**

Rauch et al. (2009) underscore the importance of nurturing a culture that encourages creativity and experimentation within organizations. They emphasize that this inclination towards innovation encompasses not only the generation of novel ideas but also the fostering of an environment where such ideas can flourish. Rather than merely seeking innovative solutions, organizations must cultivate a culture that supports risk-taking and views failure as a steppingstone to success. Furthermore, the authors emphasize the significance of continuously introducing new products and services to drive organizational growth and competitiveness. This involves understanding market dynamics, anticipating customer needs, and adapting to changing preferences. By staying attuned to market trends and customer feedback, organizations can innovate effectively and maintain their relevance in a dynamic business

environment. In addition to product innovation, Rauch et al. (2009) highlight the importance of technological leadership achieved through Research and Development (R&D) efforts in new processes. Investing in R&D enables organizations to stay ahead of the curve, develop cutting-edge technologies, and pioneer new methodologies. This technological leadership not only enhances operational efficiency but also enables organizations to differentiate themselves from competitors and establish industry leadership.

- **Risk-taking**

Rauch et al. (2009) emphasize the necessity of taking decisive steps by venturing into unexplored territories, leveraging substantial financial resources, and dedicating significant efforts to initiatives operating within unpredictable environments. They highlight the proactive stance of organizations characterized by a robust entrepreneurial orientation, illustrating their readiness to seek out fresh prospects and forge paths in unfamiliar domains. Moreover, Rauch et al. (2009) accentuate the strategic value of embracing ambiguity as a catalyst for advancement and creativity. They advocate for an assertive entrepreneurial approach, wherein enterprises display a willingness to undertake informed risks, even amid uncertain outcomes.

- **Proactiveness**

Rauch et al. (2009) expound on an entrepreneurial orientation characterized by a proactive stance towards identifying opportunities and anticipating future market demands. This perspective involves a forward-looking approach, where organizations strive to recognize emerging trends and customer needs ahead of their competitors, positioning themselves as pioneers in innovation and market leadership. In this context, firms demonstrate a keen sense of opportunity-seeking behavior, continually scanning the business landscape for unexplored niches and potential areas of growth. They exhibit agility and adaptability in responding to evolving market dynamics, utilizing their insights to develop and introduce new products and services that cater to changing consumer preferences. Furthermore, Rauch et al. (2009) highlight the importance of taking decisive action in anticipation of future demand, rather than merely reacting to present market conditions. Organizations with a robust entrepreneurial orientation proactively invest in research and development, exploring innovative technologies and methodologies to maintain a competitive edge.

Entrepreneurial Intention (Ei)

Entrepreneurial Intention (EI) acts as a guiding force, directing individuals towards entrepreneurial pursuits. It's more than just a fleeting thought; EI motivates action, pushing individuals to explore innovative business ideas and venture into uncharted territories. EI matters for various reasons: it drives economic growth by fostering new ventures and job creation, offers personal fulfillment beyond financial gains, instills resilience in entrepreneurs to navigate risks and setbacks, and is influenced by cultural, educational, and social factors (**Karan et al., 2024)**

Research Addressing Individual Entrepreneurial Intention

Research focusing on individual entrepreneurial intention aims to evaluate individuals' aspirations toward engaging in entrepreneurship as a career path. The examination of individuals' desire to become entrepreneurs offers valuable insights into the factors that influence entrepreneurial behavior and decision-making processes. Specifically, the strength of Individual Entrepreneurial Orientation (IEO) scores serves as a crucial variable in comparing individuals' intentions to embark on entrepreneurial ventures. A robust IEO score indicates a heightened inclination toward entrepreneurship, signaling a strong desire among individuals to establish and manage their own businesses. Conversely, individuals harboring aspirations to become entrepreneurs may demonstrate elevated IEO scores, reflecting their proactive and innovative mindset conducive to entrepreneurial pursuits. Empirical evidence has consistently shown a positive correlation between entrepreneurial intention and subsequent entrepreneurial actions (Zhao et al., 2010). Most of the literature addressing individual traits and attitudes toward entrepreneurship predominantly focuses on entrepreneurial intention as the primary dependent variable. Researchers employ various measures to assess individuals' propensity for entrepreneurship, as summarized in Table III. These measures primarily aim to determine whether individuals plan to pursue entrepreneurial endeavors in the future, thus reflecting their readiness to engage in entrepreneurial activities. Overall, research on individual entrepreneurial intention contributes to our understanding of the entrepreneurial mindset and provides valuable insights into the factors that influence individuals' decisions to pursue entrepreneurial careers. By exploring the relationship between IEO scores and entrepreneurial intentions, researchers gain deeper insights into the motivations and aspirations that drive individuals toward entrepreneurship, thereby informing strategies for fostering entrepreneurial development and promoting entrepreneurial ecosystems.

Research Methodology

Fostering entrepreneurial skills is crucial for driving rapid economic growth. This study aims to explore the factors influencing and predicting Entrepreneurial Orientation (EO). On one hand, the study examines the various factors contributing to the dimensions of EO. On the other hand, it investigates the impact of demographic characteristics on entrepreneurial orientation among college students. The research seeks to uncover why certain individuals are motivated to pursue entrepreneurship and whether personal attributes can predict entrepreneurial behavior. This research endeavors to shed light on the influence of these dimensions on entrepreneurial orientation among youth. Through surveys and the collection of primary data, the study employs a descriptive approach to comprehensively understand the dynamics at play.

Need of Study

In exploring the phenomenon of entrepreneurial orientation among college students, particularly those enrolled in degree programs, a critical aspect of research methodology lies in objectively assessing the extent of entrepreneurial orientation and gauging their inclination towards starting businesses. This involves employing rigorous research methods to understand the underlying factors influencing career decisions and aspirations among students.

To achieve this, a mixed-methods approach could be adopted, combining both quantitative and qualitative techniques. Quantitative surveys has been administered to a large sample of college students, collecting data on their career aspirations, attitudes towards entrepreneurship, and perceived barriers to starting businesses. Likert scale questions can be utilized to measure the level of entrepreneurial orientation, allowing for statistical analysis to identify correlations and trends.

Variable of the Study

- **Demographic Variables**

  - **Age:** Explore how age influences not only students' perceptions of risk but also their life stage considerations. Younger students may prioritize exploration and experimentation, while older students may focus more on stability and security.

  - **Gender:** Investigate potential societal and cultural factors that contribute to gender differences in entrepreneurial orientation. This

could involve examining societal expectations, access to resources, and role models within different gender groups.

- **Field of Study:** Explore how students' academic disciplines influence their entrepreneurial mindset. Students in STEM fields, for example, may be more inclined towards technology-based startups, while students in humanities may exhibit strengths in creativity and communication, which are vital for entrepreneurial success.

➢ **Psychological Variables**

- **Risk Propensity:** Dive into the nuances of students' risk preferences, examining factors such as tolerance for ambiguity, past experiences with risk-taking, and perception of risk-reward trade-offs.

- **Innovativeness:** Explore the sources of students' innovative thinking, including exposure to diverse perspectives, problem-solving skills, and creativity-enhancing experiences.

- **Self-Efficacy:** Investigate the development of self-efficacy beliefs through mastery experiences, social modeling, social persuasion, and physiological states, as outlined in Bandura's Social Cognitive Theory.

➢ **Social Variables**

- **Family Background:** Examine the intergenerational transmission of entrepreneurial attitudes and behaviors within families, considering factors such as parental role modeling, family support networks, and cultural values surrounding entrepreneurship.

- **Peer Influence:** Investigate the role of peer networks, including classmates, friends, and entrepreneurial communities, in shaping students' perceptions of entrepreneurship as a viable career path.

➢ **Cultural Variables**

- **Cultural Norms: Analyze** how cultural values, norms, and beliefs influence students' attitudes towards risk-taking, failure, individualism, and success, drawing from Hofstede's Cultural Dimensions Theory and Schwartz's Theory of Basic Human Values.

- **Societal Perception:** Examine how societal narratives and media representations of entrepreneurship shape students' perceptions of the field, including stereotypes, myths, and idealized images of success.

➢ **Educational Variables**

- **Entrepreneurship Education:** Explore the design and delivery of entrepreneurship education programs, including curriculum content, teaching methods, and experiential learning opportunities, and their impact on students' entrepreneurial mindset development.

- **Access to Resources:** Examine the availability and accessibility of entrepreneurial resources, including funding, mentorship, networking opportunities, and co-working spaces, and their influence on students' entrepreneurial intentions and actions.

➢ **Motivational Variables**

- **Opportunity Recognition:** Explore the cognitive processes involved in identifying and evaluating entrepreneurial opportunities, including pattern recognition, problem-solving, and creativity-enhancing techniques.

- **Motivation for Entrepreneurship:** Investigate the underlying motives driving students' interest in entrepreneurship, including intrinsic factors (e.g., passion, autonomy, fulfillment) and extrinsic factors (e.g., financial gain, social status).

- **Perceived Feasibility:** Examine students' perceptions of the feasibility of starting and managing a business, considering factors such as perceived barriers, available resources, and support networks.

➢ **Intention and Behavior**

- **Entrepreneurial Intentions:** Explore the formation and evolution of students' intentions to start a business, considering the interplay of motivational, cognitive, and contextual factors.
- **Actual Entrepreneurial Behavior:** Track students' engagement in entrepreneurial activities over time, including business idea generation, business plan development, venture creation, and venture growth, and identify factors that facilitate or hinder their entrepreneurial journey.

By understanding these variables, we can gain deeper insights into the factors that influence students' entrepreneurial orientation and their readiness to develop and execute a business plan.

Research Problem of the Study

In the context of entrepreneurial orientation and business planning, it is essential to identify research problems that address gaps in existing literature while aligning with our research objectives. Let's explore some key research problems:

- **Impact of Entrepreneurial Orientation on Business Planning Effectiveness**:
  - Investigate how entrepreneurial orientation influences the development and effectiveness of business plans.
  - Identify specific entrepreneurial traits that contribute to creating comprehensive and actionable business plans.

- **Role of Entrepreneurial Orientation in Opportunity Recognition and Evaluation**:
  - Examine how entrepreneurial orientation affects entrepreneurs' ability to identify and evaluate business opportunities.
  - Understand how a strong entrepreneurial orientation facilitates recognizing and integrating feasible opportunities into business plans.

- **Relationship Between Entrepreneurial Orientation and Innovative Business Planning**:
  - Analyze the extent to which entrepreneurial orientation fosters innovation within business planning.
  - Explore how entrepreneurs with high levels of entrepreneurial orientation introduce innovative elements into their plans and how this impacts overall business performance.

- **Impact of Environmental Factors on Entrepreneurial Orientation and Business Planning**:

    - Investigate how external environmental factors (such as market conditions and regulatory frameworks) interact with entrepreneurial orientation.

    - Understand how entrepreneurs adapt their business plans in response to environmental changes and how entrepreneurial orientation influences this adaptation.

- **Role of Entrepreneurial Orientation in Risk Management Strategies**:

    - Explore how entrepreneurial orientation shapes entrepreneurs' risk management approaches within their business plans.

    - Understand entrepreneurs' perceptions of risk and how they incorporate risk management strategies based on their orientation.

By addressing these research problems, our study aims to contribute valuable insights to the field of entrepreneurship and enhance our understanding of entrepreneurial behavior and effective business planning.

Research Design and Methodology

Research Method

In this study, a combination of both Primary & Secondary data has been used. Primary data is collected through the questionnaire method, which has been created using Google Forms and distributed among students. Additionally, secondary data has been incorporated to support the study.

Objective Of The study

The purpose of this study is to assess the entrepreneurial orientation level among professional students in Delhi-NCR. Specifically, it aims to delve into the underlying motivations driving Entrepreneurial Orientation (EO) and the process of creating a business plan. Additionally, the research seeks to uncover the criteria established by students and explore their diverse perspectives on EO. Furthermore, it endeavors to understand how students perceive EO and formulate business plans. Lastly, the study aims to examine various sources of satisfaction and identify which aspects are most fulfilling from the students'

viewpoint. Overall, it investigates the impact of entrepreneurial orientation on the entrepreneurial intentions of professional students in Delhi-NCR.

Population

The research focuses on a broad population, encompassing individuals at various stages of their professional and personal lives. This inclusive approach involves undergraduate students, graduates, employed individuals, unemployed individuals, and retirees. By considering individuals from diverse educational backgrounds, employment statuses, and life stages, the study aims to provide a comprehensive understanding of entrepreneurial orientation and business planning. This broad perspective allows for insights that are relevant and applicable to a wide range of demographic groups, enabling informed decision-making and the development of effective strategies to promote entrepreneurship across different segments of the population.

Sample

A stratified random sample was meticulously collected from multiple universities in the Delhi-NCR region. This deliberate approach ensured representation from various educational institutions. The sample included students from diverse academic disciplines, spanning Arts, Commerce, and Science. By incorporating participants from different universities and streams of study, the research aimed to provide a holistic understanding of entrepreneurial orientation across a wide spectrum of educational settings.

Data Collection

For this research, a combination of primary and secondary data collection methods was employed.

- **Primary Data:** The primary data collection involved direct interaction with individuals through the administration of a questionnaire. The questionnaire method was utilized to gather insights from respondents. The questionnaires were distributed online to reach a broader audience.

- **Secondary Data:** Secondary data collection involved sourcing information from existing data sources such as catalogs, internet resources, books, and research papers. Various PDFs and research papers were examined to gather relevant data for this study.

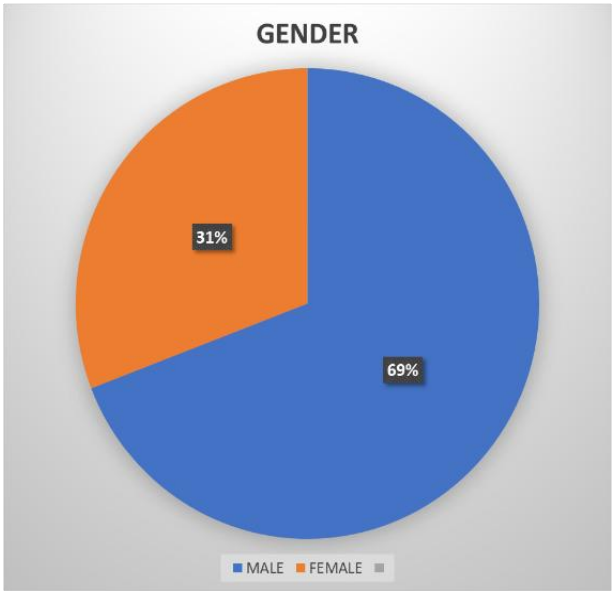
Mode of Analysis

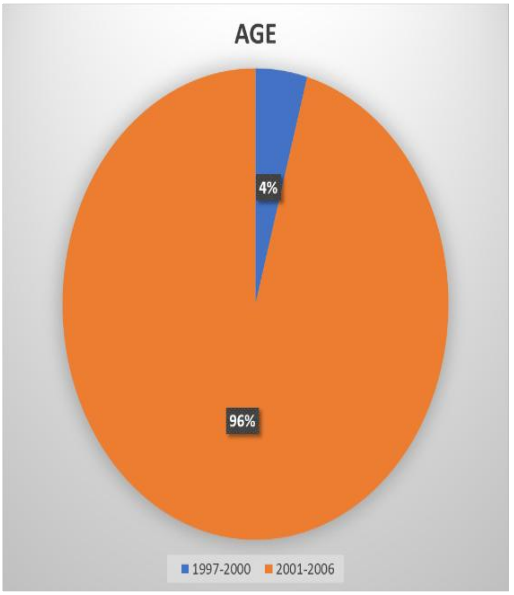
For this study, data collection relied on a questionnaire as the primary instrument. The questionnaire was chosen because it streamlined the process of data tabulation and analysis. The collected data underwent simple frequency distribution and percentage analysis to derive meaningful insights.

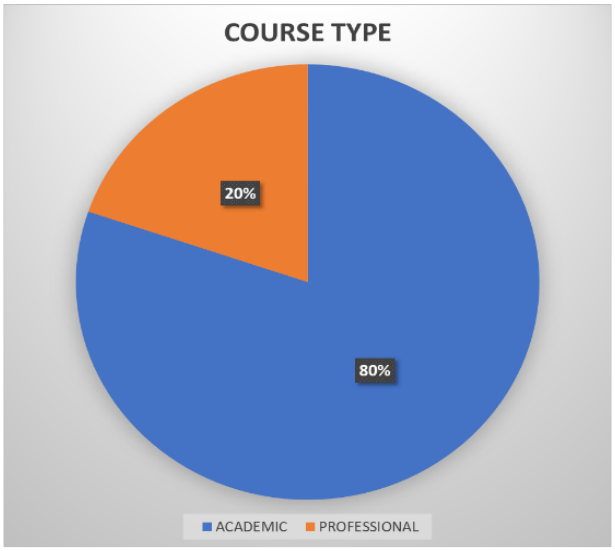
Chapter 4

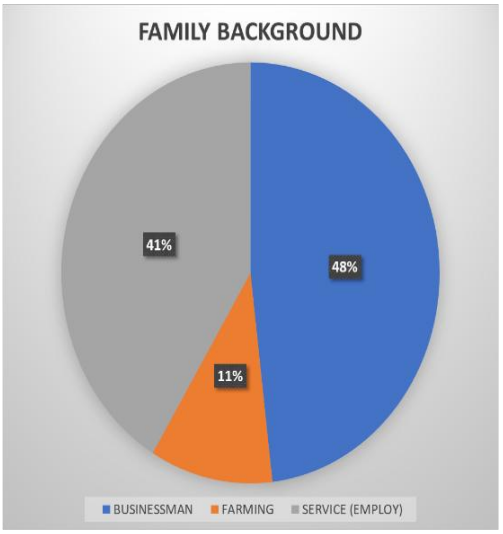
Demographic Table

Variable	Description	No. of Respondents	Percentages
Gender	Male	112	69.13%
	Female	50	30.86%
Age	1997-2000	7	4.32%
	2001-2006	155	95.60%
Course Type	Academic	130	80.24%
	Professional	32	19.75%
Family Background	Businessman	78	48.14%
	Farming	17	10.50%
	Service (Employ)	67	41.35%
Work Experience	No Experience	137	84.56%
	0-3 Years	20	12.34%
	More than 3 Years	5	3.08%











Reliability of the Scale

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.964	.965	20

Discussion: The Cronbach's Alha value **0.964** explains the scale is highly reliable for our sample.

Descriptive Statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Personal Attitude	162	1.00000	5.00000	3.3703704	1.21178934	-.635	.191	-.706	.379
Subjective Norm	162	1.00000	5.00000	3.3765432	1.08481748	-.715	.191	-.117	.379
Percieved Behaviour Control	162	1.00000	5.00000	3.0535802	1.06894190	-.352	.191	-.547	.379
Entrepreneurial Intention	162	1.00000	5.00000	3.3180247	1.07934869	-.624	.191	-.228	.379
Valid N (listwise)	162								

Correlation

Correlations

		Personal Attitude	Subjective Norm	Percieved Behaviour Control	Entrepreneurial Intention
Personal Attitude	Pearson Correlation Sig. (2-tailed) N	1 162	.635” .000 162	.676” .000 162	.660” .000 162
Subjective Norm	Pearson Correlation Sig. (2-tailed) N	.635” .000 162	1 162	.642” .000 162	.595” .000 162
Percieved Behaviour Control	Pearson Correlation Sig. (2-tailed) N	.676” .000 162	.642” .000 162	1 162	.778” .000 162
Entrepreneurial Intention	Pearson Correlation Sig. (2-tailed) N	.660” .000 162	.595” .000 162	.778” .000 162	1 162

**Correlation is significant at the 0.01 level (2-tailed)

Discussion: As per the SPSS output we can find Personal Attitude, Subjective Norm, Perceived Control Behavior, and Entrepreneurial Intention are significantly related to each other.

Regression

Model Summary[b]

Model	R	Adjusted R Square	Std. Error of the Estimate		Change Statistics					Durbin-Watson
					R Square Change	F change	Df1	Df2	Sig.F Change	
1	.802[a]	.643	.636	.65121156	.643	94.763	3	158	.000	2.014

a. Predictors: (Constant), Percieved Behaviour Control, Subjective Norm, Personal Attitude

b. Dependent Variable: Enterpreneurial Intention

Discussion: As per the SPSS output we can find that Personal Attitude, Subjective Norm, and Perceived Control Behavior are strong predictors of Entrepreneurial Intentions among university students in private Universities in Delhi NCR

T-Test

Group Statistics

Gender		N	Mean	Std. Deviation	Std. Error Mean
Personal Attitude	Female	48	3.3041667	1.15149456	.16620392
	Male	111	3.4090090	1.23211197	11694689
Subjective Norm	Female	48	3.5760417	1.08195398	15616661
	Male	111	3.3124324	1.06833619	10140198
Percieved Behaviour Control	Female	48	2.9789583	1.06026540	15303613
	Male	111	3.1008108	1.06875810	10144203
Entrepreneurial Intention	Female	48	3.2956250	95150476	13733788
	Male	111	3.3408108	1.12343235	10663148

Indepentent Sample Test

		Levene's Test for Equality of Varience s		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Personal Attitude	Equal Variences Assumed	.054	.816	-.502	.157	.616	-.10484234	.20877490	-.51721225	30752757
	Equal varience s not Assumed			-.516	95.100	.607	-.10484234	.20322480	-.50828910	29860442
Subjective Norm	Equal Variences Assumed	.000	.886	1.423	.157	.157	.26360923	.18526177	-.10231781	62953627
	Equal varience s not Assumed			1.416	88.281	.160	.26360923	.18619981	-.10640733	63362580
Percieved Behaviour Control	Equal Variences Assumed	.042	.838	-.662	.157	.509	-.12185248	.18418931	-.48566120	24195625
	Equal varience s not Assumed			-.664	89.956	.509	-.12185248	.18360431	-.48661692	24291197
Entrepreneuria l Intention	Equal Variences Assumed	1.017	.315	-.243	.157	.808	-.04518581	.18567991	-.41193877	32156714
	Equal varience s not Assumed			-.260	104.517	.795	-.04518581	.17387342	-.38996326	29953164

Discussion: As per the table above we can infer that there is no significant difference among Male and female students at private universities in Delhi NCR on Personal Attitude, Subjective Norm, Perceived Control Behavior, and Entrepreneurial Intention.

Findings

- **Relationship among Variables:** Based on the SPSS output, Personal Attitude, Subjective Norm, Perceived Control Behavior, and Entrepreneurial Intention are found to be significantly related to each other.

- **Predictors of Entrepreneurial Intentions:** The analysis reveals that Personal Attitude, Subjective Norm, and Perceived Control Behavior emerge as strong predictors of Entrepreneurial Intentions among university students in private Universities in Delhi NCR.

- **Gender Differences:** There is no significant difference observed between male and female students at private universities in Delhi NCR regarding Personal Attitude, Subjective Norm, Perceived Control Behavior, and Entrepreneurial Intention.

Discussion

- **Implications of Relationship among Variables:** The significant relationship among Personal Attitude, Subjective Norm, Perceived Control Behavior, and Entrepreneurial Intention suggests that these factors play interrelated roles in influencing entrepreneurial intentions among university students.

- **Predictive Power of Factors:** The strong predictive power of Personal Attitude, Subjective Norm, and Perceived Control Behavior highlights the importance of addressing these factors in promoting entrepreneurial mindset and intentions among students.

- **Gender Neutrality:** The absence of significant gender differences implies that factors influencing entrepreneurial intentions remain consistent across male and female students in private universities in Delhi NCR.

Conclusion

The findings of this study underscore the significance of Personal Attitude, Subjective Norm, and Perceived Control Behavior in shaping entrepreneurial intentions among university students in private universities in Delhi NCR. The interrelation among these factors highlights the complex nature of entrepreneurial decision-making processes. Furthermore, the lack of gender differences suggests the universality of factors influencing entrepreneurial intentions regardless of gender.

Recommendations:

- **Educational Interventions:** Educational institutions should design interventions aimed at fostering positive attitudes, subjective norms, and perceived control behaviors towards entrepreneurship among students.

- **Policy Implications:** Policymakers should consider integrating entrepreneurship education into the curriculum of private universities in Delhi NCR to nurture an entrepreneurial ecosystem conducive to student ventures.

- **Gender-Inclusive Initiatives:** Efforts should be made to ensure gender-inclusive entrepreneurial programs and initiatives to encourage equal participation and support for both male and female students.

- **Further Research:** Future research could explore additional factors that may influence entrepreneurial intentions among university students and delve deeper into understanding the mechanisms through which these factors operate.

These recommendations aim to enhance entrepreneurial education and support systems within private universities in Delhi NCR, thereby fostering a culture of innovation and entrepreneurship among students.

Frugal Innovation and Its Impact on Business

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Abstract

The rise and use of frugal innovations in businesses around the world appear to be gaining momentum as more businesses are slowly adapting and switching to more cost-effective means of conducting or creating their business. More businesses are adopting frugality as a means of longevity and sustainability for their operations. The concept of frugal innovation is the practice of creating products/services and even processes that observe cost-effectiveness without compromising quality as a major component of the creation of life-changing solutions to everyday living/ challenges. In this paper, researchers will look closely into the operations of manufacturing and service companies to determine how the aspect of frugality in their core business strategy and operations has contributed to their success and growth.

Keywords: Frugal innovation, Cost-effectiveness, Sustainability, Business longevity, Product/service creation, Process improvement, Affordability

Introduction

Innovation has always been the driving force and the backbone of the success of many business ventures. In India, the concept of frugality has been a norm in their way of living for centuries. Frugal innovations have been known to solve everyday problems with simple and cost-effective solutions that have been used since the beginning of time.

Frugal innovation has also been linked to simplicity, resource constraint, affordability, efficiency and its popularity in emerging economies. In the modern world, the era of dwindling resources, frugal innovation may be the long-term solution for sustainability, driving growth and fostering competitiveness. According to Harries et al (2020), frugal innovation does not indicate low quality, rather, it means providing the best possible solutions within given circumstances and constraints. The goal of frugal innovation is not just about creating low-cost alternatives, but rather developing holistic solutions which can have positive impacts on both customers' lives as well as business performance.

Frugal innovation started with creative problem-solving in places with limited resources. Now, it's used by everyone, from big companies to small businesses and even organisations helping others. This clever approach has led to delivering maximum value through affordable products, new ways of doing business, and amazing technologies that benefit everyone.

In this paper, the researchers will be looking closely into manufacturing and service companies, from start-ups to established entities that have successfully adopted or are using frugality in their core business strategy. The aim is to find the impact that frugal innovation has had in business in terms of, success rate, transformation rate and the measurement of frugality (how frugal is frugal), as well as their reception and impact on users, that has contributed/resulted in the success of the innovations.

We will delve deep into the dealings of businesses that have successfully utilized frugal innovations in today's dynamic and competitive business landscape, to find:

- The motivation behind the innovations, - to gain insights into how the founders/ creators came up with those innovations and were able to implement them successfully.

- How successful and profitable the ventures have become, through the help of financial statements that show the profits, given the restraint applied in providing the services/ processes/ products, by assessing the impact on various dimensions of business performance, including revenue growth, profitability, market share, and competitiveness. By analyzing available evidence and quantitative data, we seek to identify the key drivers and determinants of frugal innovation success and its implications for business outcomes.

- The challenges and opportunities associated with implementing frugal innovation strategies in business contexts. By examining the barriers to adoption, scalability issues, and cultural barriers, we aim to provide insights into how businesses have navigated the complexities of frugal innovation and leveraged its potential for sustainable growth and competitive advantage.

- How artificial intelligence is being utilized or contributes to the frugality of business dealings and operations to create value.

Literature Review

Frugal innovation has emerged as a strategic imperative for businesses seeking to navigate the complexities of today's global marketplace characterized by resource constraints, changing consumer preferences, and evolving technological landscapes. In this literature review, we explore the growing body of research on frugal innovation and its impact on businesses across various sectors and geographies.

Earlier studies and research work show that there are many ways to decipher what is meant by frugal innovation. According to Pavan S. Et al (2014), frugal innovation is dependent on a frugal mindset which is encouraged by a resource constraint environment, frugal processes that are adopted by poor property rights regimes and critical size of the lead market, and frugal outcomes that are influenced by the network position of innovators. Frugal innovators come in three types namely; the grassroots level, the domestic-enterprise level, and the MNC-subsidiary level.

Jaideep (2017) adds on to say that frugal innovation is an attempt to maximize the ratio of value to resources, it is about generating greater value for whoever the firm chooses to generate this value for, be it consumers, shareholders, or the society at large. It is also more concerned about the means that are employed to create value.

Frugal innovation means paying attention to how responsibly resources are used and being aware of the implications brought forth by the lack thereof. Nielsen's (2014) study of Western consumer behaviour found that 66% of Western consumers are/ was willing to pay more for products and services of companies that observe and are committed to positive social and environmental impact.

"Frugal innovation is not about de-contenting products and reducing quality levels. In some cases, frugal products may have materials and components that cost more than what was commonly used in the original products. This seemingly paradoxical situation is resolved by remembering that frugal products focus on providing exactly the value that is needed" (Wilfred A. 2017)

"Frugal products also lead to sustainable development through process optimisation and use of environmentally friendly methods. Optimised manufacturing processes and reduced product complexity save valuable resources and energy. Reusable and recyclable products bring down ownership

costs due to residual values and have a positive impact on the environment. Sustainability is inherent in frugal products." (Wilfred A. 2017)

Several factors drive and enable frugal innovation within businesses. Chesbrough and Schwartz (2007) argue that the pursuit of cost efficiencies, market expansion opportunities, and sustainability goals incentivize businesses to embrace frugal innovation practices. Moreover, the democratization of technology and the rise of open innovation platforms have democratized access to knowledge and resources, empowering entrepreneurs and enterprises to develop frugal solutions (Bhatti et al., 2018)

With technology advancing rapidly, and the use of AI gradually being embedded in today's processes, it is without doubt that it contributes immensely to cost- effectiveness, efficiency and time management. (Zeschky et al 2011) established that through technology and AI, innovators are empowered to optimize resource utilization, streamline processes and ultimately reduce production costs. In manufacturing, advanced techniques such as 3d printing or robotic automation can result in significantly lower production costs for frugal products.

Furthermore, technology and AI provide enhanced accessibility and innovation in service delivery as they bypass traditional infrastructure limitations (Randford 2015) where consumers can access services remotely without any hindrances. The use of chatbots and virtual assistants enables consumers to receive high-quality services at very little cost (Budhathoki et al 2018)

Methodology

This research aims to delve into the impact of frugal innovation on businesses in India. Here's a detailed methodology outlining the research design, data collection methods, sample selection, and data analysis techniques:

➢ Research Design and Approach

- **Multiple Case Studies:** This research will employ a multiple case study approach, exploring various companies across diverse sectors that have successfully implemented frugal innovation strategies. This allows for in-depth analysis of the specific contexts and nuances of frugal innovation within each company.

➢ Analysis Framework

To guide the analysis, consider developing a framework that categorizes the key aspects of frugal innovation. This framework could include elements like:

- **Frugal Innovation Drivers:** What factors motivated the companies to adopt frugal innovation? (e.g., resource constraints, market needs, sustainability goals)

- **Frugal Innovation Strategies:** How did the companies implement frugal practices? (e.g., product design, process optimization, business model innovation)

- **Impact of Frugal Innovation:** What were the outcomes of the companies' frugal initiatives? (e.g., cost reduction, market expansion, customer satisfaction, environmental benefits)

- **Challenges and Opportunities:** What challenges did the companies face in implementing frugal innovation? What opportunities did it create?

➢ Data Collection Methods

Company Documents and Reports

Annual reports, press releases, case studies, and other relevant documents from the chosen companies will be analyzed to obtain data on:

- Financial performance (revenue, profitability, market share).
- The motivation behind frugal innovations.
- Implementation processes and challenges.
- Outcomes and impact on business performance
- Product/service descriptions and features.
- Business models and strategies.

Industry Reports and Publications

Industry reports and publications focusing on frugal innovation in India will be used to gain broader context and insights into trends and best practices.

➢ Sample Selection

Purposive Sampling: A purposive sampling technique will be employed to select 20-30 companies across various sectors (manufacturing and service) in India. These companies will be chosen based on their:

- Demonstrated success in implementing frugal innovation strategies.
- Representation of diverse industries (e.g., healthcare, manufacturing, IT, logistics).
- Inclusion of both established players and innovative startups.
- Illustration of their cost strategies
- Determining Outcomes

➢ Data Analysis Techniques

- **Benchmarking:** Comparing the frugal innovation practices of Indian companies to those of successful companies in other countries, particularly in emerging markets, to identify best practices and potential areas for improvement.

- **Cross-Case Analysis:** A cross-case analysis will be conducted to compare and contrast the findings across the various companies. This will reveal commonalities and variations in frugal innovation approaches and their impact.

- **Surveys:** Gathering data from a broader range of companies through surveys to understand the prevalence of frugal innovation practices, the types of strategies employed, and their perceived impact on business performance.

➢ Data Management and Ethical Considerations

- All data will be carefully documented and organized for easy retrieval and analysis.
- Informed consent will be obtained from participants before conducting interviews.
- Confidentiality of participants and companies will be maintained by anonymizing data in the final research report.

➢ Expected Outcomes

This research aims to provide a comprehensive understanding of frugal innovation in Indian companies. The findings will shed light on:

- The motivations behind companies adopting frugal innovation strategies.
- The specific frugal innovation approaches implemented by different companies.
- The challenges and opportunities associated with frugal innovation in the Indian context.
- The impact of frugal innovation on business performance and customer satisfaction.

Results

This section will analyze the impact of frugal innovation on various businesses, encompassing startups and established entities across manufacturing and service sectors. The analysis will explore how these companies have integrated frugality into their core strategies, with a focus on:

- **Success rate:** This will examine the effectiveness of frugal innovation in achieving the companies' goals, potentially measured through metrics like market share growth, profitability, or customer satisfaction.

- **Transformation rate:** This will assess the extent to which frugal innovation has led to positive changes within the companies, including process improvements, cost reductions, or increased efficiency.

- **Measurement of frugality:** This will explore how the companies define and measure "frugal" practices. This could involve analyzing cost-cutting strategies, resource optimization techniques, or affordability benchmarks for products or services.

- **User reception and impact:** This will investigate how users have received and been impacted by the companies' frugal innovations. This might involve analysing user satisfaction, adoption rates, or the solutions' effectiveness in addressing user challenges.

- **Redefining Business Models:** Companies are rethinking traditional business models to enhance affordability and accessibility. This might involve innovative distribution channels, leveraging technology to streamline operations, or adopting franchise models that require less upfront investment.
- **Optimizing Resource Allocation:** A core principle of frugal innovation is the optimisation of resources. Businesses are scrutinizing their processes to identify areas where waste can be minimized. This could involve bulk procurement strategies, utilising multi-functional

workspaces, or adopting cloud-based solutions to reduce infrastructure costs.

- **Leveraging Technology for Efficiency:** Technology plays a crucial role in enabling frugal innovation. Companies utilizing digital platforms to connect with customers more efficiently, automate tasks, and improve data-driven decision-making. This allows them to operate with lean teams and reduce operational overhead.

These tables showcase how Indian companies across manufacturing and service sectors have leveraged frugal innovation to achieve success. It analyses their:

- **Business Model:** This column describes the core structure of how the company operates and generates revenue.

- **Cost Strategy:** This section highlights the specific approaches used by the company to minimize costs and optimize resources.

- **Outcomes:** This column details the positive results achieved by the company through frugal innovation, such as increased affordability, improved efficiency, or wider market access.

Table 1: Frugal Innovation in manufacturing sector of India

Industry	Companies and Products	Business Model	Cost Strategy	Outcomes
M A N	Tata Motors Tata Nano	**Target Market:** Middle-class families in India with limited budgets, aiming to move from motorcycles/ Scooters to a car. **Value Proposition:** Affordable, basic transportation with decent fuel efficiency.	**Focus on Functionality:** Stripped-down design with minimal features to reduce complexity and cost. **Material Innovation:** Extensive use of high-quality, lightweight plastic panels instead of steel for weight reduction and cost savings. **Smart Manufacturing:** Streamlined production processes and innovative assembly techniques.	**Success:**Initially, the Nano was hailed for its affordability, making car ownership **Challenges:** Safety concerns due to lack of airbags and initial perception of the Nano as a "cheap car" led to a decline in sales.
	Godrej & Boyce ChotuKool	**Affordable Price Point:** Chotukool was significantly	**Modular Design: Utilizing** Standardized, easily replaceable components	**Success:** ChotuKool created a new market segment, making basic refrigeration accessible

U F A C T U R I N		cheaper than conventional refrigerators, opening up ownership for a new segment. **Distribution Strategy:** Leveraged existing Godrej networks to reach rural areas and smaller towns.	reduce manufacturing complexity and spare part costs. **Locally Sourced Materials:** Sourcing readily available materials in target regions lowers overall production costs. **Streamlined Manufacturing:** Focusing on efficient production processes optimizes costs without compromising quality.	to millions in India. **Sociallmpact:** Improved food storage and reduced spoilage, leading to better nutrition and health outcomes. **Brand Image:** Godrej gained recognition for its commitment to social innovation.
	SELCO: customized solar home systems, solar lanterns, solar water heaters, and other renewable energy products	**Base of the Pyramid (BoP) Market:** Targets rural and low-income communities where access to grid electricity is limited. **Value Proposition:** Provides reliable, clean energy solutions that improve living standards and livelihoods. **Social EnterpriseModel:** Operates with a dual focus on social impact and financial sustainability.	**Product Design:** Usesreadily available, low-cost materials while maintaining quality and durability. **Local Sourcing:** Focuses on sourcing components from local vendors to reduce transportation costs and support local economies. **Skilled Workforce:** Trains local technicians for installation and maintenance, creating jobs and reducing reliance on expensive external expertise.	**Energy Access:** Providesclean, reliable electricity to millions in rural India, improving lighting. Communication and powering small appliances. **Economic Empowerment:** Creates job opportunities through local technician training and stimulates local economies through product sales. **Environmental Impact:** Reduces dependence on fossil fuels and promotes sustainable energy practices.
	GE Healthcare MAC 400(portable ECG machine) Lullaby(a baby warmer)	**Affordable Pricing:** TheMAC 400 and Lullaby are priced significantly lower than traditional options, making them accessible to a wider range of healthcare providers. **Targeted Distribution:** GE Healthcare partners with local distributors and NGOs to ensure these products reach	**Modular Design:** Utilizing standardized, easily replaceable components reduces manufacturing complexity and spare part costs. **Locally Sourced Materials:** Sourcing readily available materials in target regions lowers overall production costs. **Streamlined Manufacturing:** Focusing on efficient production processes	**Enhanced Diagnostics:** The MAC 400 allows for earlier detection of heart problems in areas with limited access to advanced equipment. **Improved Neonatal Care:** The Lullaby helps regulate body temperature for newborns, contributing to better infant health outcomes.

G		the intended markets. **Training and Support:** Providing basic training and maintenance support ensures healthcare workers can effectively utilize the equipment.	optimizes costs without compromising quality.	

Table 2: Frugal Innovation in manufacturing sector of India

INDUSTRY	COMPANIES	BUSINESS MODEL	COST STRATEGY	OUTCOMES
S **E** **R**	**Ixigo**	**Freemium model**: the basic app features are free, with users paying a commission fee only when they book travel through the platform **Focus on Profitability**: Unlike many other starups prioritizing rapid user growth, Ixigo has a reputation for prioritizing profitability and building a sustainable business model	**Lean Startup Approach**: Ixigo emphasixes on building essential features first and iterating based on user feedback, minimizing development waste. **Focus on Automation**: they leverage automation in taskslike data analysis and customer support to reduce operational costs.	**Market Differentiation**: the multi app approach and focus on user experience have helped Ixigo differentiate itself from competitors in the Indian market **Reduced customer Acquistion Cost:** Ixigo's frugal approach has led to a lower customer acquisition cost compared to competitors with more aggressive marketing strategies.
	Practo	**Multi stakeholder Value Proposition**: Practo caters to patients, doctors, and health care institutions. **Patients**: Easy appointment booking online consultations, medical record management. **Doctors**: Increased patient reach, appointment management tools, online consultation	**Cloud based Platfrom**: Reduces infrastructure costs and enables scalability. **Focus on core functionality**: Prioritizes core features for user needs, avoiding unnecessary development expenses. **Data-driven Optimization**: Utilizes data analytics to optimize operations and marketing efforts	**Increased access to Healthcare**: Practo makes healthcare services more accessible, particularly in remote areas. **Improved Efficiency**: The platform streamlines processes for both patients and healthcare providers, saving time and resources. **Growth and Expansion**: Practo's frugal approach has fueled its growth and expansion into new

V		capabilities. **Institutions**: improved operational efficiency, patient engagement tools.		markets.
I	**UDAAN**	**Focus on untapped Market**: Udaan targets the vast network of kirana Stores that were stores that were underserved by traditional B2B channels. **Subscription Model**: Udaan charges sellers an annual subscription fee for access to the platform and its services. This provides a predictable revenue stream. **Commission based Revenue**: Udaan earns a commission on each transaction completed on the platform, further incentivizing its growth.	**Lean Startup Approach**: Udaan focuses on core functionalities and avoids unnecessary features, keeping development and maintenance costs. **Data-driven Decision making**: Udaan utilizes data analytics to optimize operations minimize waste, and target marketing efforts effectively. **Focus on Automation:** Automation in order fulfilment and customer services helps streamline processes and reduce manpower needs.	**Empowering Small businesses:** Udaan provides kirana stores with access to a wider product selection, competitive prices and credit facilities, boosting profitability. **Increased Efficiency**: The platform reduces overall transaction costs and streamlines the supply chain, benefiting both buyers and sellers. **Market Expansion**: Udaan has facilitated the growth of B2B e-commerce in India, creating a more efficient and inclusive marketplace.
C	**GoMechanic**	**Subscription model:** offer subscription plans for routine maintenance, oil changes or roadside assistance at a discounted price compared to individual service charges. Freemium Model: provide a basic level of service (eg. Basic car health check) for free, upselling more complex repairs or premium services at an additional cost.	**Standardization**: standardize service processes and use common tools across locations to optimize efficiency and reduce training costs **Performance based incentives:** motivate technicians through incentives based on completed repairs instead of hourly wages, potentially reducing labour costs.	**Increased customer base**: attract budget conscious customers with affordable service options. **Improved operational efficiency** : Streamlined processes and tech enabled solutions can lead to faster turnaround times and reduced overall costs
E	**Urban Clap**	**Subscription**	**Technology driven**	**Increased Service**

		Model: Urban Clap charges subscription and generates 85% of its overall revenue from subscriptions. **Commission based Revenue:** Urban Clap earns commission from each vendor and serviceman, business owner for work done.	**Platform**: Urban Clap leverages technology to automate tasks like scheduling, payments, and communication, minimizing manual intervention and associated costs. **Standardized Processes:** Streamlined processes for on-boarding service professionals and managing bookings ensure efficiency and cost-effectiveness. **Focus on local Service Providers:** Urban Clap taps into a network of local service professionals, eliminating the need for expensive in-house training or equipment	**Availability:** Urban Clap makes various services readily available customers, even in areas where such services might be limited previously. **Flexibility and Convenience**: Customers can book services at their convenience through the platform. **Economic Opportunity**: Urban Clap creates income opportunities for a large pool of service professionals, promoting a gig based economy.
	Lens kart	**Online Platform:** Bypassing expensive brick and mortar stores, Lenskart offered eyeglasses directly to customers at competitive prices. **Focus on Value:** Provided a wide variety of trendy and affordable frames along with prescription lenses. **Virtual Try-on Technology**: incorporated an app based feature allowing customers to virtually try on classes before buying, reducing returns.	**Standardized designs**: offers a curated selection of frames manufactured efficiently, avoiding excessive inventory and lowering costs. **Direct to customer Model**: Eliminated middlemen, allowing Lenskart to control pricing and offer better value to customers. **In-house Manufacturing:** Established its own manufacturing facilities to optimize production processes and reduce reliance on external vendors.	**Success**: Lenskart has become a major player in the Indian Eyewear market, offering high-quality products at accessible prices. **Increased access to Eye care :** By making eyeglasses affordable, Lenskart has improved vision care for millions in India. **Convenience**: The online Platform provides a convenient and hassle free way for customers to purchase eyeglasses.
	OYO	**Standardization**: OYO partners with independent hotels, offering a consistent experience across locations at budget- friendly prices. **Focus on technology:** OYO's mobile app	**Renovation Efficiency :** OYO has developed rapid renovation techniques to quickly upgrade partner hotels, minimizing downtime and cost**.** **Bulk Procurement:** OYO negotiates bulk deals with suppliers for essential amenities like linens and toiletries,	**Increased Supply**: OYO has significantly increased the availability of standardized budget-friendly accommodations, especially in underserved markets. **Improved Customer Experience:** Standardization

		simplifies booking, payment, and guest experience management, reducing operational costs. **Franchise Model**: OYO leverages a Franchise Model, minimizing capital investment in physical assets.	reducing costs for both OYO and its partners. **Data-Driven Management:** OYO leverages data analytics to optimize pricing, manage inventory (rooms), and target marketing efforts efficiently.	ensures consistent quality and service across OYO hotels. **Benefits for Partners:** independent hotels gain access to OYO's booking platform, marketing expertise, and operational guidance, leading to higher occupancy rates.

Industry	**Companies and Products**	**Business model**	**Cost stratergy**	**Outcomes**
	Amul Bulk Milk Coolers	**Improved Milk Quality:** Higher quality milk translated into a wider range of value-added dairy products (cheese, yogurt), generating more revenue for Amul. **Farmer Benefits:** Reduced spoilage meant higher incomes for farmers, strengthening Amul's cooperative model. **Operational Efficiency:** BMCs led to cost savings in transportation and processing due to larger, fresher milk collections.	**Focus on Functionality:** The design prioritized functionality over bells and whistles, minimizing costs. Standardization: Standardize d components across BMCS simplified maintenance and reduced spare part costs. **Local Expertise:** Leveraging local skills for maintenance potentially brought down service costs compared to relying solely on trained technicians	**Sustainable Supply Chain:** BMCs ensured a more sustainable milk collection process, reducing spoilage and waste. **Win-Win Situation:** Both farmers and Amul benefited from improved milk quality and efficiency. **Market Leadership:** Amul solidified its position as a leader in India's dairy industry by focusing on innovation for social good.
	Ecozen Solutions: Ecofrost, a portable cold room & Ecopump, a solar-powered water	**Value Proposition:** Increased profitability for farmers through reduced post-harvest losses (Ecofrost) and efficient water management (Ecopump). **Financing Options:** Ecozen collaborates with government schemes and NGOs to offer	**Modular Design:** Both products have a modular design for ease of production, maintenance, and potential future upgrades. **Thermal Management:** Ecofrost uses innovative thermal storage solutions	**Reduced Food Waste:** Ecofrost significantly reduces post-harvest losses, leading to higher incomes for farmers. **Improved Water Management:** Ecopump provides reliable irrigation with

		financing options, making the products more accessible to smallholder farmers.	instead of expensive batteries, keeping costs low. **Data-Driven Approach:** Ecozen utilizes data collected from the products to continuously improve efficiency and identify cost-saving opportunities.	lower energy costs, promoting sustainable water usage. Climate Impact: By using solar power, both products contribute to reducing greenhouse gas emissions.
	Embrace Innovations: Embrace Warmer	**Value Proposition:** Increased profitability for farmers through reduced post-harvest losses (Ecofrost) and efficient water management (Ecopump). **Financing Options:** Ecozen collaborates with government schemes and NGOs to offer financing options, making the products more accessible to smallholder farmers.	**Modular Design:** Both products have a modular design for ease of production, maintenance, and potential future upgrades. **Thermal Management:** Ecofrost uses innovative thermal storage solutions instead of expensive batteries, keeping costs low. **Data-Driven Approach:** Ecozen utilizes data collected from the products to continuously improve efficiency and identify cost-saving opportunities.	**Reduced Food Waste:** Ecofrost significantly reduces post-harvest losses, leading to higher incomes for farmers. **Improved Water Management:** Ecopump provides reliable irrigation with lower energy costs, promoting sustainable water usage. **Climate Impact:** By using solar power, both products contribute to reducing greenhouse gas emissions.

	Pidilite: Favicol	**Mass Market Penetration:** Fevicol targets a wide audience, from everyday consumers to professional carpenters. **Value Proposition:** Strong, reliable adhesive at an accessible price. **Wide Distribution Network:** Fevicol leverages a vast network of distributors and retailers to reach every corner of India.	**Economies of Scale:** High production volume allows Pidilite to negotiate better deals with raw material suppliers and achieve cost efficiencies. **Focus on Efficiency:** Streamlined processes minimize waste and production costs.	**Market Dominance:** Fevicol enjoys a dominant market share in India, synonymous with adhesives. **Brand Recognition:** Fevicol has become a household name, a testament to its quality and **Value. Affordability:** Fevicol Makes strong bonding solutions accessible to a vast consumer base.

Table 4. Frugal Innovation in service sector of India

Industry	**Companies and Products**	**Business model**	**Cost stratergy**	**Outcomes**
	Urban Clap	**Focus on Untapped Market:** Udaan targets the vast network of kirana stores that were underserved by traditional B2B channels. This creates a new market opportunity. **Subscription Model:** Udaan charges sellers an annual subscription fee for access to the platform and its services. This provides a predictable revenue stream.	**Technology-Driven Platform:** Urban Clap leverages technology to automate tasks like scheduling, payments, and communication, minimizing manual intervention and associated costs. **Standardized Processes:** Streamlined processes for onboarding service professionals and managing	**Increased Service Availability:** UrbanClap makes various services readily available to customers, even in areas where such services might have been limited previously. **Flexibility and Convenience:** Customers can easily book services at their convenience through the platform.

		Commission-based Revenue: Udaan earns a commission on each transaction completed on the platform, further incentivizing its growth.	bookings ensure efficiency and cost-effectiveness. **Focus on Local Service Providers:** UrbanClap taps into a network of local service professionals, eliminating the need for expensive in-house training or equipment.	**Economic Opportunity:** UrbanClap creates income opportunities for a large pool of service professionals, promoting a gig-based economy.
	Lenskart	**Online Platform:** Bypassing expensive brick-and-mortar stores, Lenskart offered eyeglasses directly to consumers at competitive prices. **Focus on Value:** Provided a wide variety of trendy and affordable frames along with prescription lenses. **Virtual Try-On Technology:** Incorporated an app-based feature allowing customers to virtually try on glasses before buying, reducing returns.	**Standardized Designs:** Offered a curated selection of frames manufactured efficiently, avoiding excessive inventory and lowering costs. **Direct-to-Consumer Model:** Eliminated middlemen, allowing Lenskart to control pricing and offer better value to customers. **In-House Manufacturing:** Established its own manufacturing facilities to optimize production processes and	**Success:** Lenskart has become a major player in the Indian eyewear market, offering high-quality products at accessible prices. **Increased Access to Eyecare:** By making eyeglasses affordable, Lenskart has improved vision care for millions in India. **Convenience:** The online platform provides a convenient and hassle-free way for customers to purchase eyeglasses.

			reduce reliance on external vendors.	
	Oyo	**Standardization:** OYO partners with independent hotels, offering a consistent experience across locations at budget-friendly prices. **Focus on Technology:** OYO's mobile app simplifies booking, payment, and guest experience management, reducing operational costs. **Franchise Model:** OYO leverages a franchise model, minimizing capital investment in physical assets.	**Renovation Efficiency:** OYO has developed rapid renovation techniques to quickly upgrade partner hotels, minimizing downtime and cost. **Bulk Procurement:** OYO negotiates bulk deals with suppliers for essential amenities like linens and toiletries, reducing costs for both OYO and its partners. **Data-Driven Management**: OYO leverages data analytics to optimize pricing, manage inventory (rooms), and target marketing efforts efficiently.	**Increased Supply:** OYO has significantly increased the availability of standardized budget- friendly accommodations, especially in underserved markets. **Improved Customer Experience:** Standardization ensures consistent quality and service across OYO hotels. **Benefits for Partners:** Independent hotels gain access to OYO's booking platform, marketing expertise, and operational guidance, leading to higher occupancy rates.

Discussion

Analysis of various companies across diverse sectors in India showcases the transformative potential of frugal innovation. This section delves deeper into the key takeaways from this table, linking them to the broader research context and current research problems.

Frugal Innovation: A Catalyst for Growth and Inclusion

The Indian business landscape thrives on value consciousness. Frugal innovation empowers companies to cater to this market reality by creating cost-effective solutions that don't compromise in quality. Examples like ixigo (travel), Practo (healthcare), and Udaan (e-commerce) demonstrate how technology can be leveraged to streamline operations and offer affordability to customers. This fosters business growth by expanding the consumer base and creating a win-win situation for both businesses and cost-conscious customers.

Resource Optimization: Redefining Efficiency

Frugal innovation encourages businesses to rethink resource allocation and identify cost-saving opportunities. Go Mechanic's bulk procurement strategy and Urban Company's omnichannel approach exemplify this. By optimizing resource utilization, companies not only reduce operational costs but also become more environmentally sustainable.

Innovation beyond Products: Reimagining Business Models

The impact of frugal innovation extends beyond products. Companies like Oyo (hotels) and Lenskart (eyewear) have adopted innovative business models that ensure affordability and accessibility. Oyo's franchise model and Lenskart's multi-channel strategy demonstrate how frugal innovation can redefine customer touchpoints and enhance the overall experience.

Frugal Innovation: A Bridge to Sustainability

Sustainability is an emerging concern for businesses worldwide. Frugal innovation offers a path towards environmentally conscious practices. Companies like Ecozen Solutions (cold storage) and Amul (milk transportation) showcase how frugal solutions can minimize resource consumption and promote eco-friendly operations. This alignment with sustainability goals positions businesses favorably in the competitive landscape.

Addressing the Research Problem

The case studies analyzed provide valuable insights to address the research problem of understanding and implementing frugal innovation effectively. By dissecting these examples, a framework can be developed that outlines key considerations for businesses:

- **Understanding Customer Needs:** Frugal innovation thrives on a deep understanding of customer needs and constraints. Companies must prioritize value creation for the target audience.

  - **Leveraging Technology:** Technology plays a crucial role in optimizing processes and reducing costs. Identifying the right technological solutions is essential for successful frugal innovation.

  - **Optimizing Resource Allocation:** Resource constraints can be a catalyst for innovation. Businesses should explore ways to streamline operations and minimize wastage.

  - **Building Scalable Business Models:** Frugal innovation needs to be sustainable in the long run. Developing scalable business models ensures long- term growth and impact.

- **Future Research Directions**

Further research can explore the challenges associated with frugal innovation, such as balancing affordability with quality and navigating cultural barriers. Additionally, investigating the role of government policies and infrastructure development in fostering a frugal innovation ecosystem would be valuable. By delving deeper into these aspects, researchers can contribute to a more comprehensive understanding of frugal innovation and its potential to revolutionize businesses in India and beyond.

Conclusion

This research investigated the impact of frugal innovation on businesses in India. By analyzing a diverse range of companies across various sectors, the study revealed the transformative potential of this approach. Frugal innovation empowers businesses to cater to the value-conscious Indian market by creating cost-effective solutions without compromising on quality or sustainability.

- **Key Findings and Contributions**

The research yielded several key findings that contribute to the understanding of frugal innovation in the Indian context:

- **Frugal Innovation Drives Growth and Inclusion:** Businesses that embrace frugal innovation can expand their customer base by offering affordable products and services. This fosters inclusive growth and caters

to the needs of a broader segment of the population.

- **Resource Optimization for Efficiency and Sustainability:** Frugal innovation encourages businesses to optimize resource allocation, leading to cost reductions and fostering environmentally sustainable practices.

- **Innovation beyond Products: Reimagining Business Models:** The impact of frugal innovation extends beyond products. Businesses can adopt innovative business models that ensure affordability and accessibility, such as franchise models and omnichannel strategies.

- **Aligning with Sustainability Goals:** Frugal innovation often leads to solutions that minimize resource consumption and promote eco-friendly operations, positioning businesses favourably in the current sustainability- conscious landscape.

➢ Restatement of the Research Objective

The primary objective of this research was to examine how frugal innovation impacts businesses in India. The analysis focused on how companies implement frugal practices, the resulting benefits, and the overall contribution to business success.

➢ Overall Conclusion: Frugal Innovation - A Strategic Imperative

Frugal Innovation has a positive impact on both businesses and consumers alike. This is substantiated by the intensity of consumers engaging in the usage of sustainable products in their daily lives. Frugal innovation is no longer for use in resource- constrained societies, but rather by developed societies and individuals who find sustainability and longevity an appealing solution to the world’s resource problems; as developed nations also face the problem of scarcity of resources.

Frugal innovations provide solutions to resource constraints and improved efficiency in resource utilization and optimization. This implies that the use of frugal products and services is not only rising, but it is also going to be a way of life for generations to come. Businesses that use frugality will surely see exponential growth as consumers will be more inclined to the use of products of businesses that use economic and environmentally sound business practices.

The research overwhelmingly supports the conclusion that frugal innovation is a strategic imperative for businesses operating in India. By adopting frugal practices, companies can achieve several key objectives:

- **Enhanced Competitiveness:** In a cost-conscious market, frugal innovation allows businesses to offer competitive pricing and cater to a wider customer base.

- **Increased Profitability:** Optimizing resource allocation and streamlining operations leads to cost reductions, ultimately enhancing profitability.

- **Sustainable Growth:** Frugal innovation fosters long-term growth by creating scalable business models and aligning with environmental sustainability goals.

- **Positive Social Impact:** By offering affordable solutions, businesses can contribute to social development and improve the quality of life for a broader segment of the population.

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Neo Banking in India - An Opportunity or Challenge

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Abstract

The aim of this research paper is to find out whether Neo Banking is an opportunity or challenge for India. The study involves using questionnaires administered to 52 respondents to identify the awareness of the Neo Banking concept in India and also whether they have utilised their services and what do they feel about it as an opportunity or challenge.

Keywords: neo-banking, opportunity, challenges, digital bank

Introduction

Neo-banks are totally online, digital banking institutions. Simply put, they are not physically present. Customers may find traditional banking transactions time- consuming and labour-intensive. Neo banks add a digital and experiential layer on top of traditional banking to make online banking smooth. Customers can quickly create accounts on their website or app and use their services because they are tech-driven. Neo-banks are becoming more and more popular as a customer alternative because they offer a number of benefits that meet the changing needs of modern consumers. They want to make banking services easy to use and respond swiftly to customer demands.

Internet use and the number of people with smartphones are growing faster in India than in many other countries. Neo-banks have benefited from this situation by providing services that are based on technology. This has drawn a lot of millennial and technologically advanced people. Neo-banks fill the gap between what traditional banks offer and what customers expect in the digital age. They are revolutionising the fintech sector and may someday surpass traditional banks.

Some people can confuse “neo-banks” with “digital banks.” They are equivalent in that they both provide financial services via smartphones and other mobile devices. The similarities stop there, though. Digital banks are typically the online-only sections of well-known and licenced players in the banking industry, even if the names are occasionally used interchangeably. A neo-bank, on the other hand, runs exclusively online; it has no physical branches and can work independently or alongside conventional banks. This

allows them to comply with the regulations and manage the regulatory environment.

India has experienced a fintech boom over the past several years, with the emergence of hundreds of new fintech businesses. Neo banks are a big part of these fintech companies that are changing the way traditional banks work. By providing tech-first solutions, these investment companies are filling the void in the established banking sector

Literature Review

Koibichuk et al. (2021) describe the efficiency and potential technological change in the banking sector conducted in 90 countries focusing on the level of risk and cyber frauds based on Neo-Banking using the gravitational model. The overall study uses four factors: supply conditions, demand conditions, institutional environment and Innovation & change with a total of 13 components subdivided among four factors. The study uses gravitational force to estimate the level of risk in money laundering concerning neo-banking. The study concluded that using Neo- banking as an innovation to the banking system, the risk of fraud reduces showing that approx. 37% of countries have no risk, 25% of countries experienced a low degree of risk and the same proportion agree to medium level risk (PwC, 2021). Only 12.2% of countries see innovation as a high level of risk which too may be due to their poor IT infrastructure.

Amal Dethe (2020) in his article stated that the growth of the Neo Bank in India will be more if the Regulator is changing its stance. The regulator RBI is not providing a licence to the standalone operation of Neo-bank. It will reduce the growth of Neo Banks.

Kapil Rana (2021) in his article stated that the profit of the Neo Banks is slim due to heavy competition in the new sector. The new entrants are facing stiff competition from the banking market leaders SBI and ICICI.

Fritschi, L. N., (2019, May) has mentioned in his paper that the financial crisis of 2008 was triggering the growth of new entrants like Fintech, to improve their services and introduce products using a new brand of entities called the Neo banks. They looked at the possible disruption of the existing banks by these new players, using the disruptive innovation theory of Clay Christenson in the context of the Swiss banking sector. Their study suggests that Neo banks cannot be considered as disruptive yet and the incumbents are dealing with a sustaining strategy when attempting to internalise technology related to digitalisation.

Pant, S. K. (2020). Fintech: Emerging Trends. Telecom Business Review, 13(1), has examined the role of Fintech in leveraging technology to deliver banking and financial solutions to individual and enterprise customers. According to him it is one of the fastest-growing sectors in both developed & developing countries with India amongst the top three fintech start-ups globally. Blockchain, Cryptocurrency, AI, Data Analytics, Machine learning, big data, Robotics, and Cloud are being leveraged by fintech firms to deliver products. The emerging trends include IMF focus on leveraging fintech for cross border payments using distributed ledger technology, Augmented reality for customer satisfaction, Digital insurance, Digital invoicing, Crowd-funding, Crowd investing, Robotics investment advisory, Future relationships between Banks and Fintech firms, Central bank regulatory role, was looked into .Since there is not much research work carried out on fintech in India, they believe there is an opportunity for further research on innovation and growth of fintech in India.

Branzoli, N., & Supino, I. (2020) have in their paper on empirical research on Fintech credit to households and non-financial corporation, has focused attention on the factors supporting the development of innovative business models for credit intermediation, such as marketplace lending; the benefits of new credit risk assessment data and methods; the implications of these innovations for access to edit.

Their study finds that growth of lenders with innovative business models is mainly driven by the degree of local economic development and of competition in the banking sector. Further new data and methods can improve traditional credit risk models because they assist better in filtering possibly delinquent borrowers, such as those with scant credit history. Finally, they conclude that, FinTech borrowers generally lack (or have limited) access to finance and tend to be riskier than traditional bank borrowers.

Dokania, 2019, Samanta, 2018 -A critical analysis conducted in India with regard to regulations and law of Neobanking and its comparative analysis of progress in India with rest of the world have given an overall image on the stage of neobanking progress in India. It was found that with India’s high reliance on internet Electronic copy available at and online transactions has made India a highly potential market opportunity for Neobanking.

Bhasin, 2020-in his study stated the role of Neo Banks in India. The research emphasized the integration of technology and artificial intelligence to provide a seamless service for the customer. The study also focused on the enterprises which are looking forward to enter the Indian Market.

Palepu, Advait Rao, 2019 -in his research aimed at establishing a relation with Capital Investment and the reachability of Neo Banks. The study also focused on the need for the limitations that were being imposed by RBI on these NEO Banks. The author also specifies that the prospect of Neo Banks in India shall flourish more and in a better manner in the Indian Market in comparison with any other market as the need and requirement of obtaining digital services is comparatively more in the country

Agarwal and Nagar, 2020-in their study has pointed about the constant changing. Environment in the banking industry. They have mentioned about the basic difference between Neo Banks and digital banks. They have also highlighted the essence of Neo Banks by bringing out their benefits and shortcomings. The study has also brought to light the mechanism in which these Neo Banks function and operate.

Hopkinson, Turcam Klarova and et al,2019-The study highlighted the essence of the transformation brought about by the Neo Banks. It underlined the importance of the emergence of these Neo Banks and the reasons behind the same. The study suggested that it is only due to Neo Banks that the customers can invest in mutual funds. The flexibility of investing and using banking services as and when they want and also how customers can get an additional interest via investing in these Neo Banks Kothari,2017-The study does not include anything on the lines of FinTech or Neo Banks, but the study explains the functioning of a commercial bank. The study helps to draw a comparison between the Neo Banks and Traditional Banks.

Advait Rao Palepu in his article “India’s Neo-Banks: What’s So ‘Neo’ About Them?” 6 have done quantitative research where he has mentioned about the global approach of the neo banks in terms of capital investment and global reach. This paper also talks about the regulatory framework for neo banks in India and also stated reasons for the restrictions imposed by RBI on certain aspects where neo banks cannot deal in. He also mentioned in his paper that neo banks have great opportunities in India because they have targeted the customer segment with digital services which they are providing much more than what traditional banks are providing. This paper has also mentioned in his paper about such companies showing interest in doing business in India and their market analysis.

Vanita D’souza in her article “5 Neo Banks that are changing the way India Does banking” has included the a report published by ‘Allied Market Research’ which states the growth rate of neo banks from year 2017 to 2020, the research also mention about the view of the customer and their preference in respect of neo bank. This article also states that neo bank has a great

opportunity in the Indian market and can be proved beneficial for MSMEs in terms of loan advancement, ease of payment method, creditworthiness. Thus, the author has taken reference of this article for the purpose of analysing the market condition and in what ways MSMEs can be benefited from neo banks.

Raghav Agarwal and Avneesh Singh Nagar in their article "Neo Banks and the next banking revolution" 7 they have mentioned how the business of banking is changing rapidly. They have further differentiated between digital bank and neo bank with a case study of e-KYC and UIDAI. They have pointed out certain advantages of neo bank and the challenges and shortfalls of neo bank. Later they have discussed the structure of neo banks like their core infrastructure, B2C/B2B Modules. Thus, from this article the author has taken reference of the structure of neo banks and how they channel end to end service, then author has also referred to the advantages and shortfalls of neo bank from this article.

Gabriel Hopkinson, Romeo V. Turcam, Diana Klarova and Valeria Gulieva in their article "How neo banks business models challenge traditional banks" have mentioned about the revolution that has been brought by the neo banks in the banking sector and have also stated the reason for such a great revolution i.e. transparency, Low-cost structure, end to end customer services, 24*7 customer support, money management tools etc. They have also mentioned how neo banks have made investment easy for everyone. Now everyone can invest into mutual funds without any difficulty. Neo banks also provide them with the flexibility of anytime switch in or switch out which is widely attracting customers for investments through neo banks, not only this but customers also get higher rate of interest than what they get through traditional banks. They have also focused in this article about the future of the banking sector. However, the author has only taken the reference to the future of the banking sector as a relevant part for the purpose of research.

Vinod Kothari in his book "Banking Law and Practice in India" 9 has talked about various functions performed by commercial banks in order to provide services to its customers. Though this book does not talk about the function of a neo bank or a fin-tech firm, it will help the author to compare the functions of a commercial bank with that of a neo bank is providing to its customers and what other functions a neo bank can provide in future.

Michael Magrath in his article "Top Regulatory Consideration for Neo Bank "10 has mentioned about the various challenges faced by the neo banks in providing services to its customers mainly in respect with privacy of data. He said that most of the customers are having the same concern about whether their data and money will be safe in neo bank." So he has given a certain way to

overcome these challenges. He said in his article that the layering of security is very important in order to protect customer's privacy. The author has used this article as reference for the purpose of writing challenges faced by neo banks.

Visalakshmi & Rasiah 2017 -The banking industry can benefit from the Fintech revolution concerning employee engagement, higher productivity, and internal operational control. Fintech building a diverse model and agile in the upliftment of the banking domain frequently improving the financial services. The challenges consist of lack of financial literacy, data security encryption and some consumer protection regulations.

Research Gap

The studies done on neo banking are limited as per literature available particularly with respect to Indian context. The concept of neo banking is a newer and innovative way of banking and still Indian banking has not diversified into this field of banking. This encouraged us to do study on the topic to get more insights into neo structure banking.

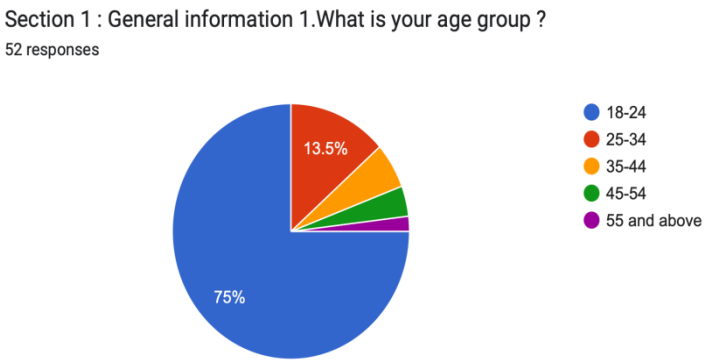
Objectives

- To examine the evolution of Neo banking as a disruption to the Legacy Banking in India.
- To study the trend of Fintech concerning the Banking sector of India.
- To study the growth and operational mechanism of Neo Bank.
- To understand the digitization and pros and cons in the banking industry.

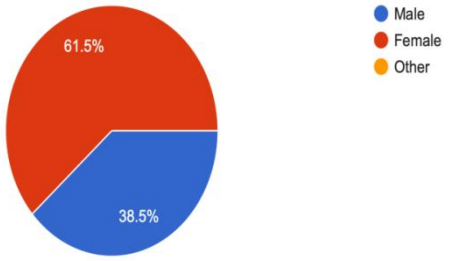
Research Methodology

Type of Research: Descriptive Research
Target Sample: Banking Sector
Type of sampling: Descriptive
Sampling size: 52
Tools used: Questionnaire

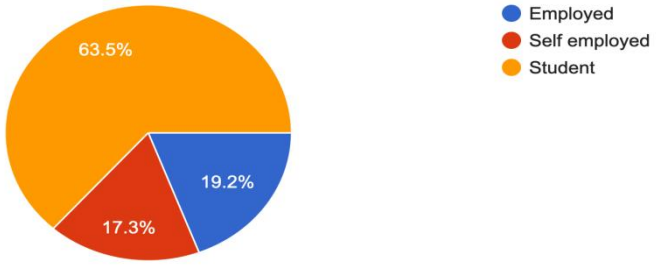
Data Analysis



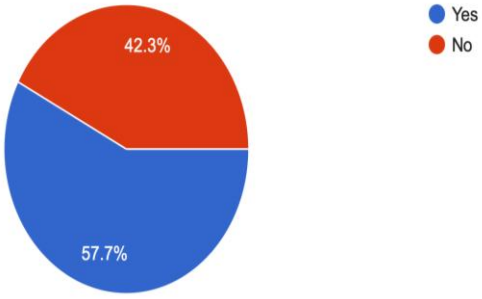
2. What is your gender?
52 responses



3. What is your occupation ?
52 responses

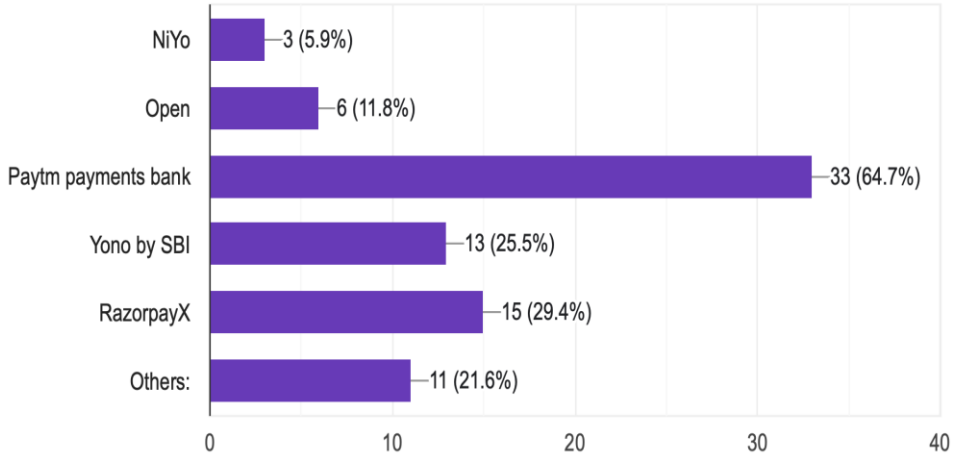


Section- 2: User perspective towards Neo banks 4. Have you heard Neo banks before?
52 responses



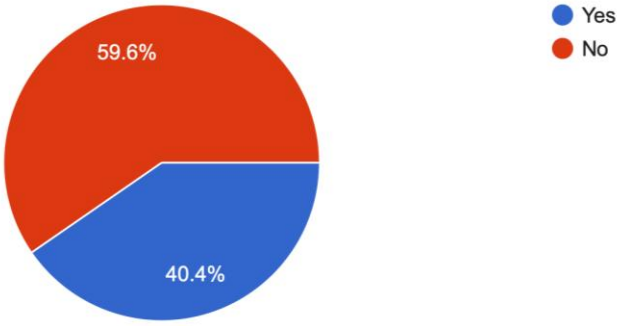
5. Which of the following Neo banks have you heard of?

51 responses



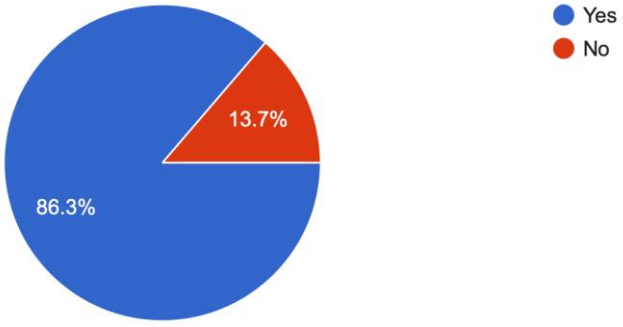
6. Have you ever used a Neo bank before?

52 responses



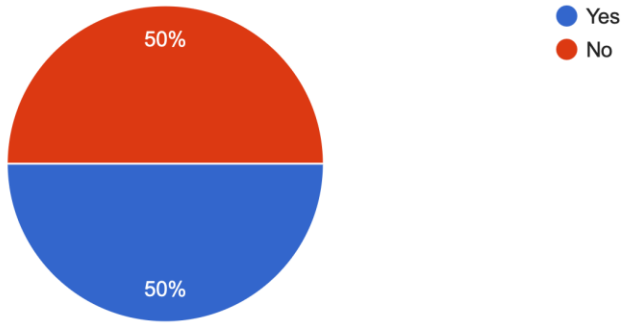
7. Do you think Neo bank can improve financial inclusion in India?

51 responses



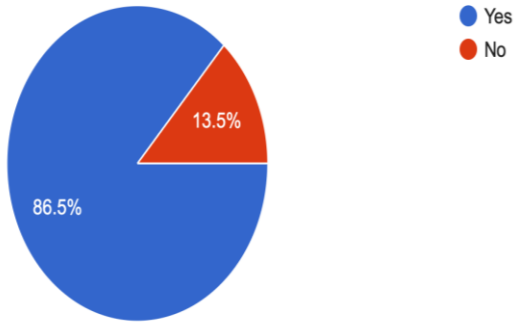
8. Have you ever used any financial planning tools or service?

52 responses



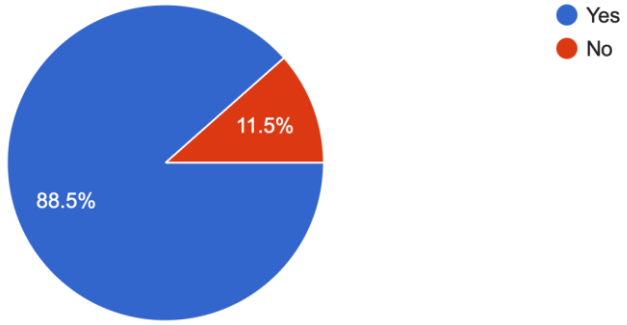
9. Do you think Neo banks can provide better financial planning tools and services as compared to traditional banks?

52 responses



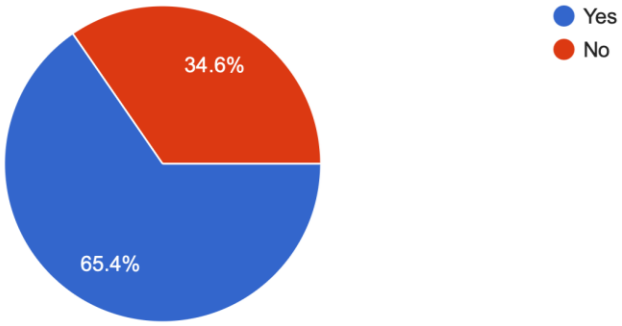
10. Do you think Neo bank can help improve financial literacy in india?

52 responses



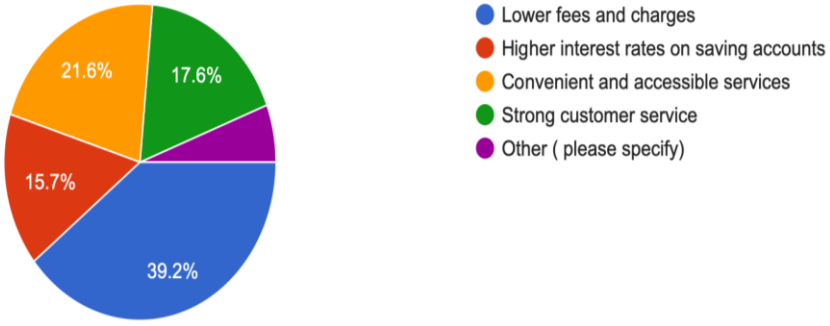
11. Would you be willing to switch to a Neo bank for your banking needs?

52 responses



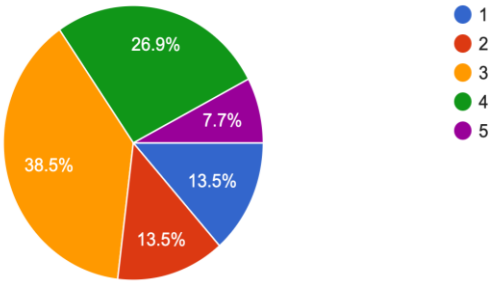
12. What features would you like to see in a Neo bank?

51 responses

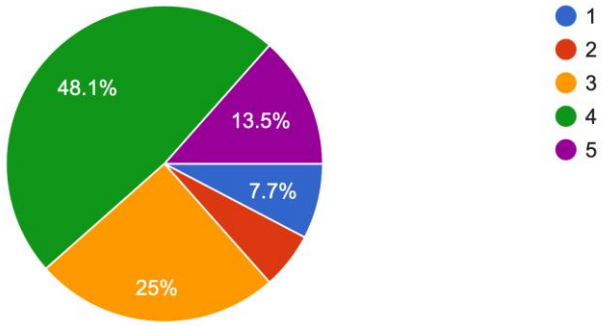


Section -3: Financial planning and Financial inclusion through Neo banks 13. On a scale of 1 to 5 how much does the following statements with resp...esources on financial planning and management

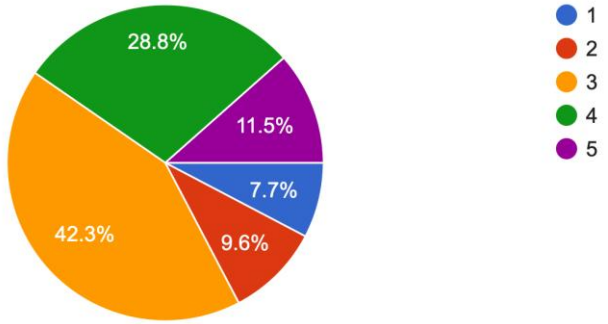
52 responses



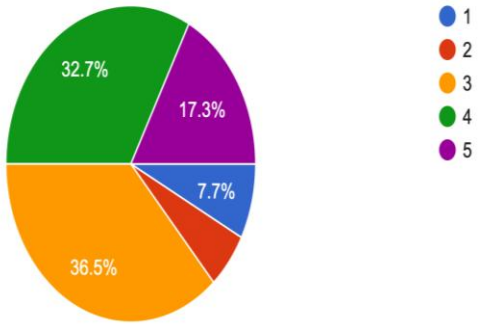
b) Providing financial planning tools and services to users
52 responses



c) Partnering with educational institutions to provide financial literacy
52 responses

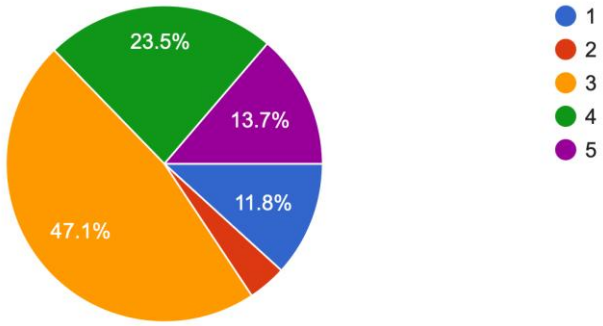


14. On a scale of 1 to5 how much does the following statements with respect to Neo banks contribute to increase financial inclusion in India? ...5 being the highest? a) Low-cost banking services
52 responses



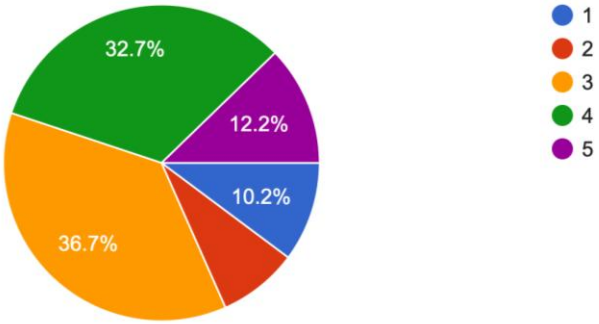
b) Services to unbanked and underbanked (like Gig Economy and MSME)

51 responses



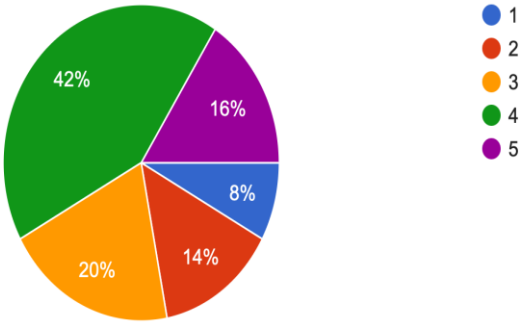
c) Partnering with government organizations to ach people in remote areas

49 responses



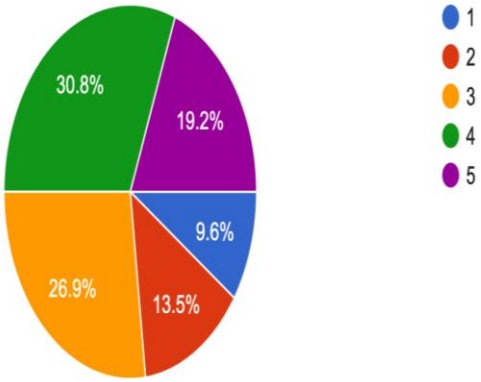
d) Partnering with private organization's to reach people in remote areas

50 responses



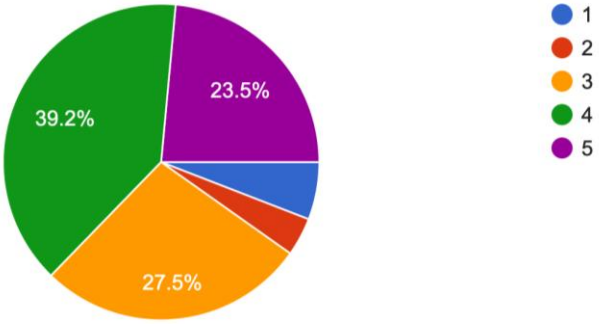
15. On a scale of 1to5 how much does the following statements with respect to Neo banks contribute to better financial planning in india? (1 ... highest) a)Intuitive personalised budgeting tools

52 responses



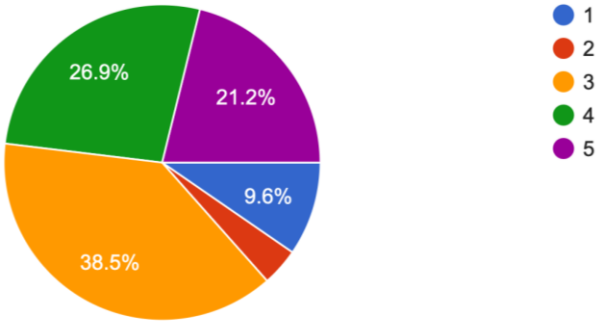
b) Goal based saving and investment tools

51 responses



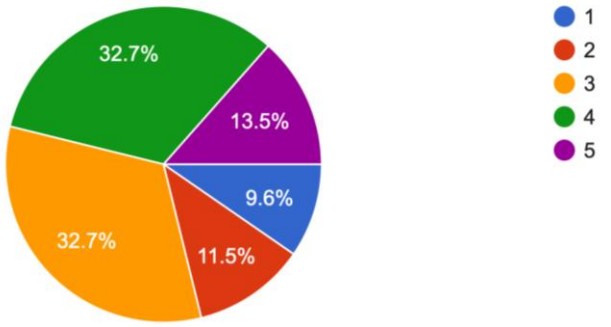
c) Retirement planning tools

52 responses



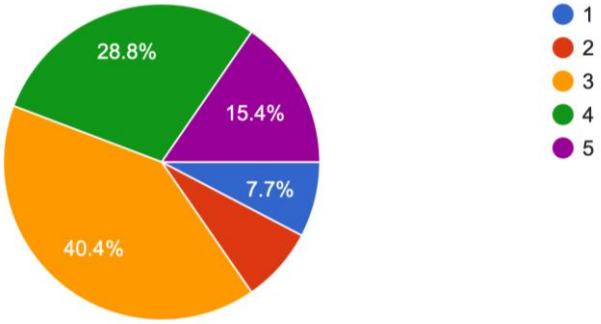
d) Tax planning tools

52 responses



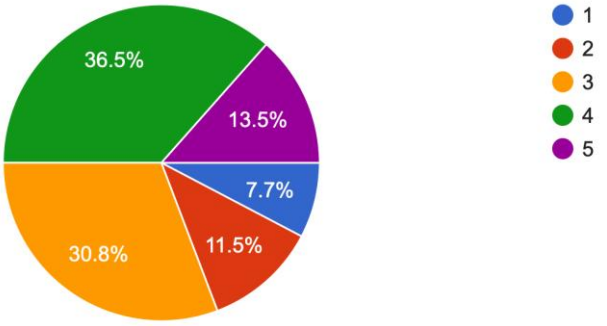
e)Insights on overhead expenses (categorised by duration)

52 responses



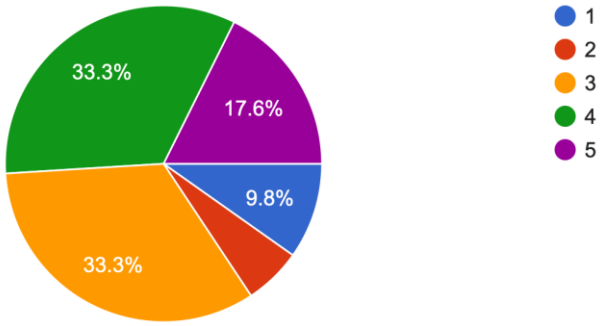
f) Insights on overhead expenses (categorised by nature)

52 responses



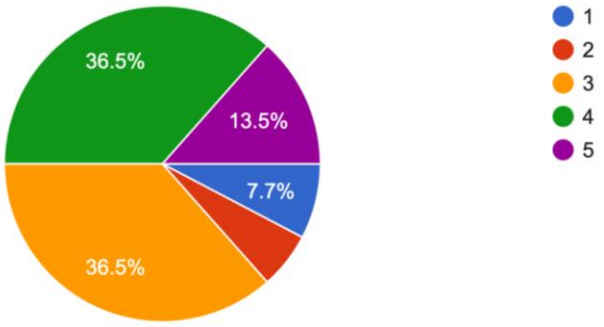
h) Question and answers feature (fetch KYC status, IFSC code, etc?

51 responses



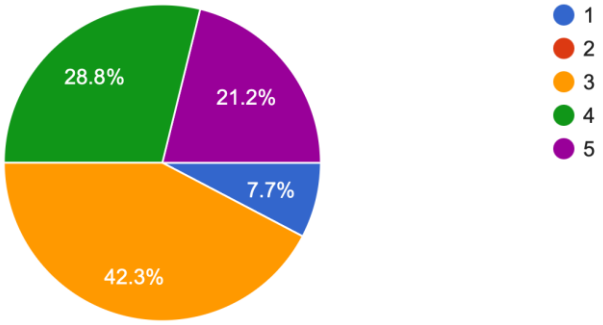
i) Command feature (invest in MF, pay Ajay, download financial statements , etc)

52 responses



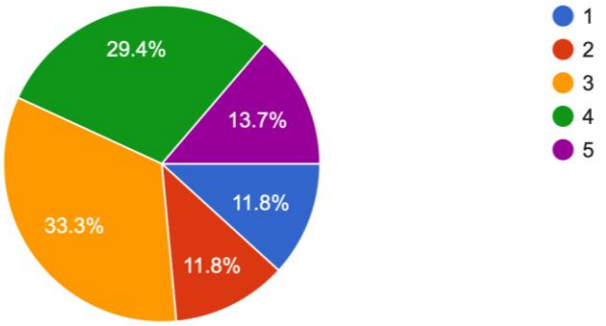
j) Alternative credit scoring

52 responses



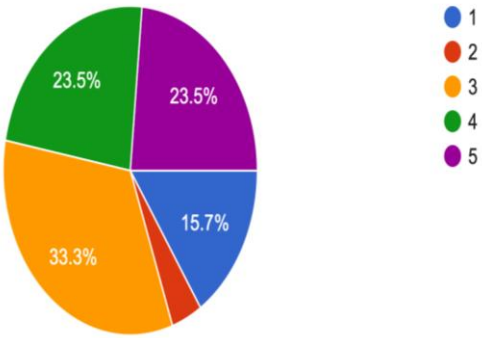
k) Voice assistance for financial advice

51 responses



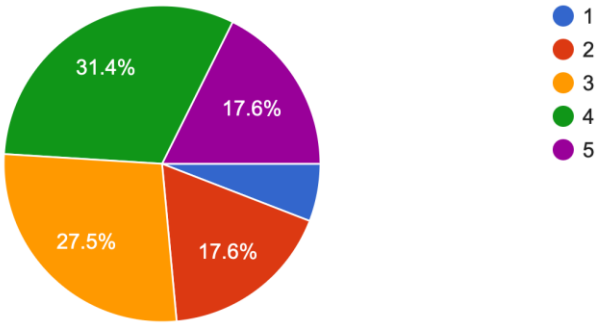
16. On a scale of 1 to whic of the following is major hurdle in growth of Neo banks in india ? (1 being lowest and 5 being the highest? a) Lack of advanced cyber security systems

51 responses



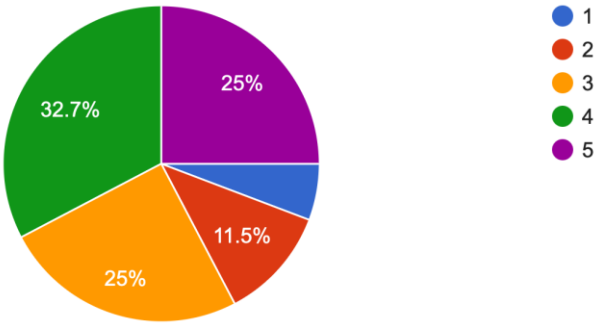
b) Low customer conversion and trust building

51 responses



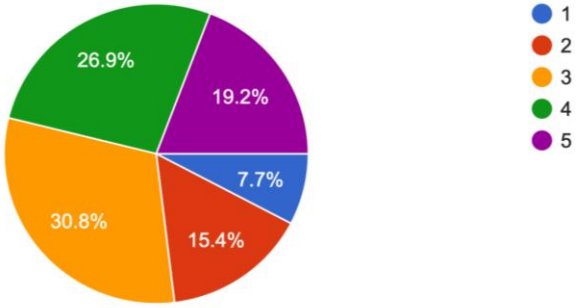
c) Low customer retention and relations

52 responses



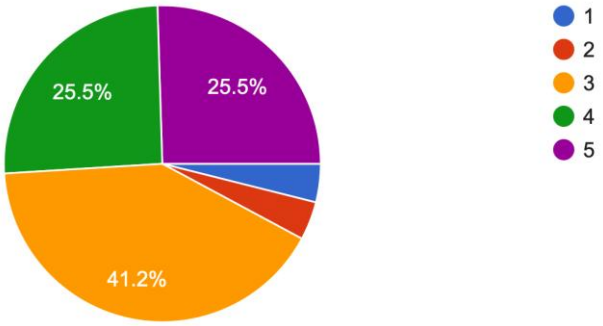
d) Regulatory complaince by RBI with respect to physical existence and licensing

52 responses



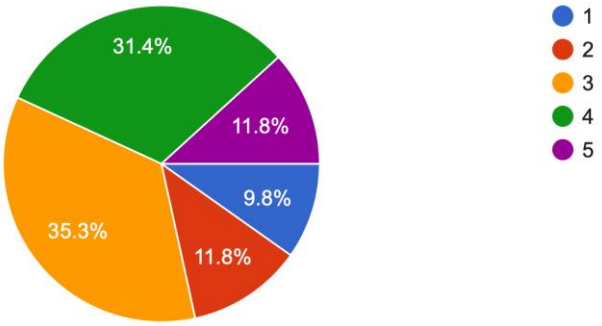
e) Low financial literacy among people

51 responses



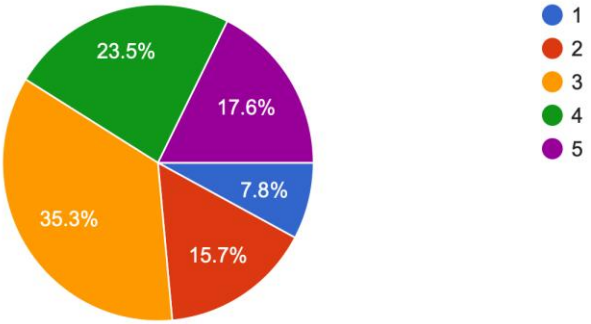
f) High implementation cost

51 responses



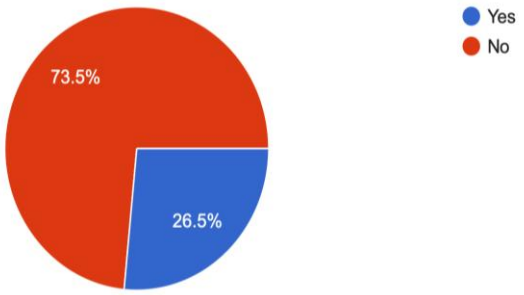
g) Limited resources

51 responses



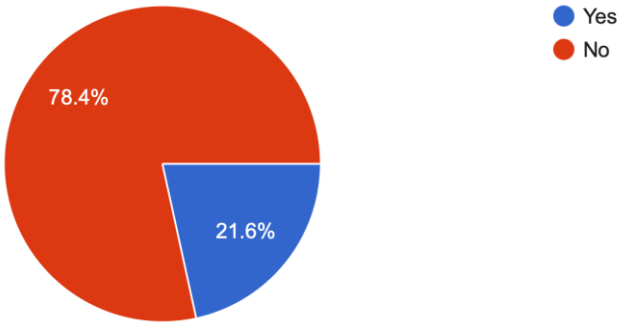
SECTION -4: Related to FI. Money Neo bank features 17. Have you used FI.money Neo bank?

49 responses



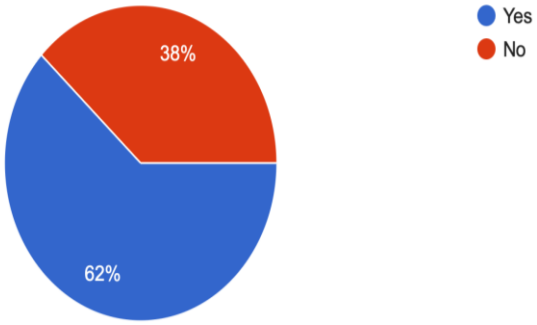
18. Are you aware of its Ask.Fi feature of Fi.money?

51 responses



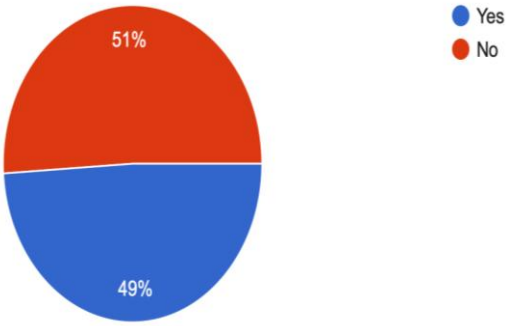
19. Do you think feature of providing insights on your overhead expenses will help you plan your finances better ? (Ex. Uber spending 2023 or shoping spending for April)?

50 responses



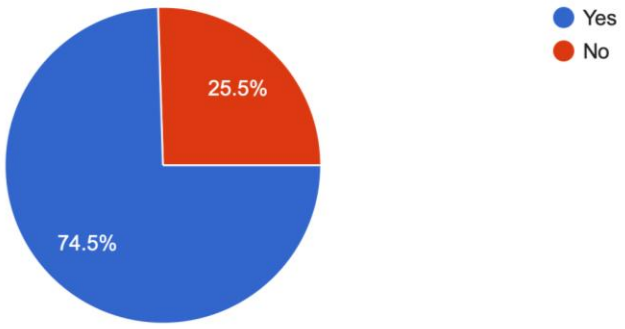
20. Would you be willing to pay for daily / monthly/yearly financial planning insights shared through push notifications ?

51 responses



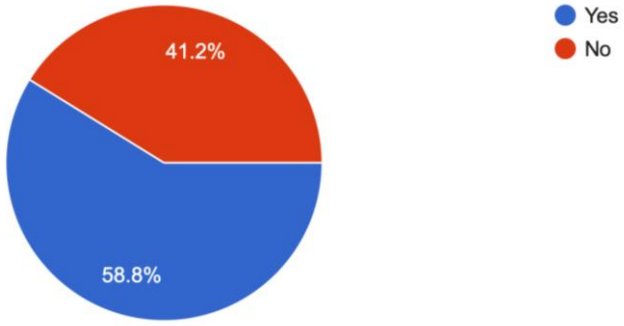
21. Would features like "show debit / credit card offers or account statements" etc. using search option help in better financial comparison and planning?

51 responses



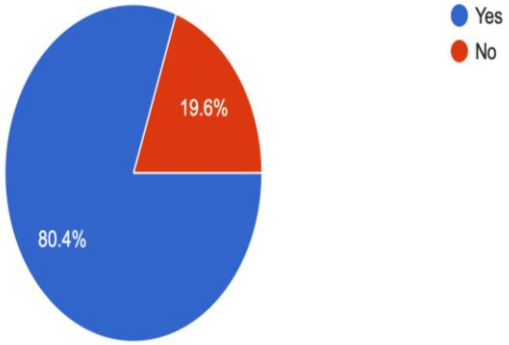
22. Would you pay for getting the best debit / credit card offers ?

51 responses



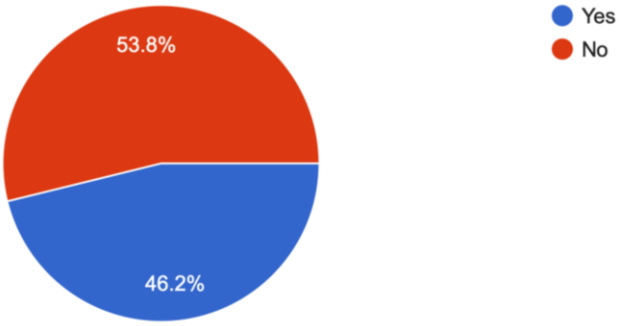
23. Would Q/A features to answer basic financial questions like "what is my IFSC code or Fi federal saving account number or how do I order a check boo...facilitate better financial planning and actions ?

51 responses



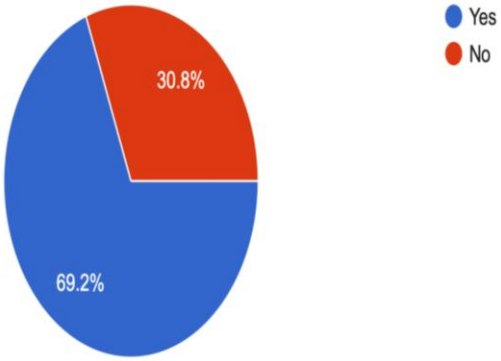
24. Would you pay Neo bank for activating Q/A features?

52 responses



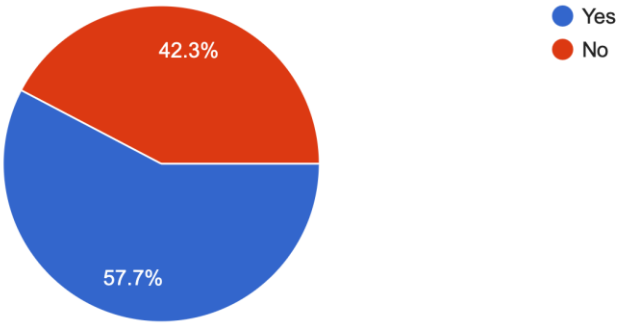
25. Do you think command feature for tasks like " download financial statement , or pay Priya or invest in mutual funds" etc. help in better financial planning and actions ?

52 responses

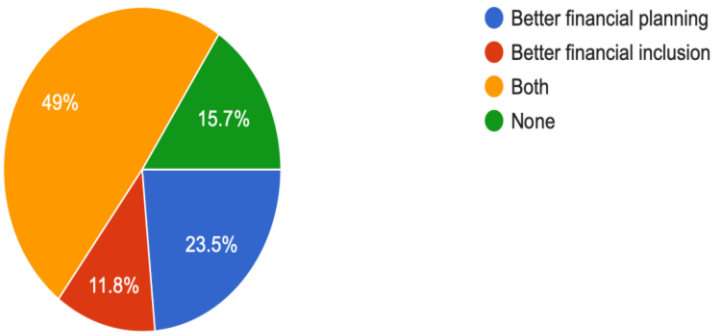


26. Would you pay Neo banks to activate command feature ?

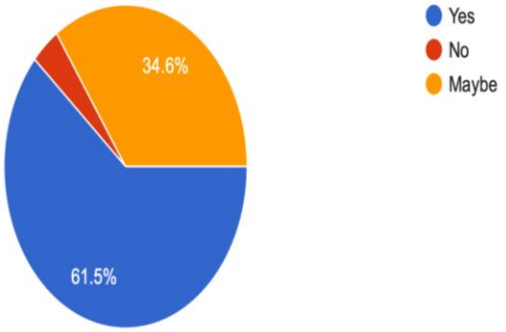
52 responses



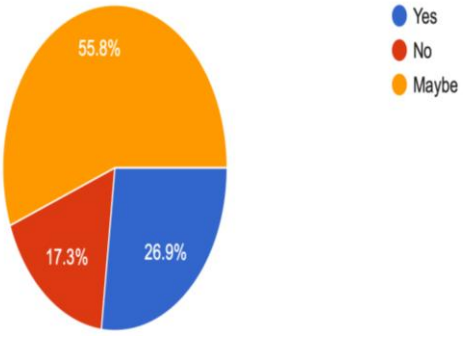
27. According to you Neo bank like Fi.Money can lead to:
51 responses



28. Do you think with increasing digitalization it has become easier for the Neo banks to reach larger audience especially reaching out to rural population?
52 responses



29. Would you like to switch to Neo banks due to better financial planning ad action features ?
52 responses



Findings/ Results

Majority of the people belong to the age group of 18-24 year-end and most of them have heard about Neo banks before. These banks can provide

better financial planning tools and services as compared to traditional banks. It can also improve financial literacy in India. People would like to see features like, lower fees and charges, higher interest rates on saving accounts, convenient and accessible services.

Neo banks contribute to better financial planning in India through intuitive personalised budgeting, goals based on saving and investment tools, retirement planning tools, insights on overhead expense, better credit /debit card offers. Major hurdles in the growth of Neo Banks are lack of advanced cyber security systems, low customer conversion and trust building, low customer retention and relations, regulatory compliances by RBI with respect to physical existence and licensing, high implementation cost, limited resources.

The Fi.Money feature offered by Neo banks is not known much by many people but it can provide great insights on your overhead expenses and will help you to plan your finances better.

With an increasing digitisation it has become easier for the Neo banks to reach larger audience especially reaching to rural population

Conclusion/ Discussion

In the present banking era, Indian banks are facing challenges and opportunities in the digital banking scenario. The GOI has initiated a campaign named Digital India program to ensure better customer service at their doorstep. By implementing digitalisation in the banking sector now the customers can access the bank's products and services at their convenient time from anywhere and anytime. It allows the users to make online payments, open new accounts, make fund transfers, etc. This started shifting the paradigm from paper and cash- based banking to paperless and cashless banking. Many financial innovations were introduced to their users such as internet banking, mobile banking, UPI payments, QR codes, Mobile Wallets, etc. Banks can adopt more innovative solutions and technologies for Counter balance and security measures too.

How far Neo banks can go in disrupting the banking sector remains to be seen. While some have achieved rapid growth to date, they are yet to be adopted in large numbers by the mainstream market. Therefore, whilst they exhibit characteristics of disruptive innovation, a significant market disruption is yet to occur. First and foremost is in winning the trust of consumers. Experience and reputation are widely deemed as crucial factors for many customers in their choice of bank, so being newcomers to the market; many consumers are hesitant to trust Neo banks with their life savings, mortgage or other services.

Getting Customers to use them as their main bank is therefore proving to be a challenge.

Increasing their customer base will prove to be crucial to the long-term sustainability of their business models. While they can continue growing through capital investment, they are to yet to achieve significant revenue and are incurring yearly losses. Secondly, many traditional banks are beginning to respond, in some cases by launching their own greenfield digital banks or by investing into Fintechs to improve their customer experience.

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Relationship between Diabetes and Osteoporosis

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Abstract

Background The paper examines the intricate relationship between diabetes mellitus (DM) and osteoporosis, highlighting bidirectional influences and shared pathophysiological mechanisms. Chronic hyperglycaemia in DM contributes to bone loss through increased oxidative stress, inflammation, and hormonal dysregulation, while osteoporosis may exacerbate glucose metabolism impairment and insulin resistance. Future research should focus on longitudinal studies and elucidating molecular pathways to guide effective prevention and management strategies for these intertwined conditions.

Methodology A qualitative survey study was done in which 100 eligible subjects were chosen based on the inclusion and exclusion parameters. After receiving the consent, subjects were asked to fill up the proforma. Statistical analysis was then done based on their responses.

Result The survey of 100 people revealed a notable association between diabetes and osteoporosis, with a majority expressing awareness of the link between the two conditions. Respondents identified lifestyle factors such as diet and physical activity as crucial determinants of bone health and glycaemic control.

Conclusion: A significant proportion reported experiencing bone-related complications or fractures alongside their diabetes diagnosis. However, there was a lack of understanding regarding specific management strategies targeting both conditions simultaneously. These findings underscore the need for comprehensive education and integrated care approaches to address the complex interplay between diabetes and osteoporosis and optimize patient outcomes.

Key words: Diabetes, Osteoporosis, Risk factor.

Introduction

Diabetes mellitus and osteoporosis are two prevalent chronic conditions that pose significant challenges to global public health. While traditionally

viewed as distinct entities affecting different organ systems, emerging evidence suggests a complex interrelationship between these conditions, with implications for both clinical management and public health policy **(Rangel EB et al., 2019)**. As the prevalence of diabetes and osteoporosis continues to rise worldwide, understanding the nature of their association is imperative for developing effective prevention and management strategies. This introduction provides an overview of the bidirectional relationship between diabetes and osteoporosis, highlighting key epidemiological, pathophysiological, and clinical aspects.

The prevalence of diabetes has reached epidemic proportions globally, with an estimated 537 million adults living with the condition in 2021, a figure projected to rise to 784 million by 2045 **(International Diabetes Federation, 2021)**. Diabetes is characterized by chronic hyperglycaemia resulting from insulin deficiency (Type 1 diabetes) or insulin resistance (Type 2 diabetes), leading to microvascular and macrovascular complications affecting multiple organ systems. Osteoporosis, on the other hand, is a skeletal disorder characterized by low bone mass, deteriorated bone tissue, and increased risk of fractures. It is estimated that osteoporosis affects over 200 million people worldwide, with fracture-related morbidity and mortality posing substantial economic and healthcare burdens **(Kanis et al., 2019).** While these conditions have traditionally been studied independently, growing evidence suggests a bidirectional relationship between diabetes and osteoporosis, with each condition influencing the pathogenesis and clinical course of the other.

Several epidemiological studies have documented an increased risk of osteoporosis and fractures among individuals with diabetes. Meta-analyses have reported a 1.3 to 1.7-fold higher risk of hip fractures in individuals with Type 2 diabetes compared to non-diabetic counterparts, with similar findings observed for vertebral and non-vertebral fractures **(Vestergaard, 2007; Janghorbani et al., 2007).** Furthermore, individuals with diabetes tend to experience fractures at younger ages and have poorer outcomes following fractures, including increased mortality rates and longer hospital stays **(Janghorbani et al., 2007; Napoli et al., 2017).** Conversely, osteoporotic fractures have been identified as independent risk factors for the development of Type 2 diabetes, with studies reporting a 1.2 to 1.3-fold increased risk of diabetes following hip fractures **(Schwartz et al., 2017; Vestergaard et al., 2009).** These epidemiological findings underscore the need for a deeper understanding of the underlying mechanisms linking diabetes and osteoporosis.

The pathophysiological mechanisms underlying the association between diabetes and osteoporosis are multifactorial and involve complex interplay between metabolic, hormonal, and inflammatory pathways. Chronic

hyperglycemia in diabetes contributes to increased oxidative stress, inflammation, and the formation of advanced glycation end-products (AGEs), all of which adversely affect bone metabolism **(Saito & Marumo, 2010).** AGEs accumulate in bone tissue, leading to impaired collagen cross-linking and decreased bone strength. Furthermore, alterations in hormonal profiles, including insulin, adiponectin, and leptin, in individuals with diabetes further exacerbate bone loss and impair bone quality **(Shu et al., 2015)**. Insulin resistance, a hallmark of Type 2 diabetes, has been implicated in the dysregulation of osteoblast and osteoclast function, leading to decreased bone formation and increased bone resorption **(Yamamoto et al., 2016).** Additionally, dyslipidemia and hyperlipidaemia commonly observed in individuals with diabetes may contribute to bone fragility through alterations in lipid metabolism and inflammatory cytokine production **(Zhukouskaya et al., 2020).**

Conversely, osteoporosis may contribute to the pathogenesis of diabetes through several mechanisms. Low bone mineral density (BMD) and fractures, characteristic of osteoporosis, may impair glucose metabolism and insulin sensitivity through mechanical loading effects and alterations in adipokine secretion (Schwartz et al., 2017). Furthermore, inflammatory cytokines released during bone remodelling processes can promote insulin resistance, fostering the onset of diabetes (Xiao et al., 2014). The bidirectional relationship between diabetes and osteoporosis highlights the need for integrated approaches to prevention and management, targeting both skeletal and metabolic health.

Literature Review

It is well established that osteoporosis and diabetes are prevalent diseases with significant associated morbidity and mortality **(Koromani F et al., 2020).** Patients with diabetes mellitus have an increased risk of bone fractures. In type 1 diabetes, the risk is increased by approximately 6 times and is due to low bone mass. Despite increased bone mineral density (BMD), in patients with type 2 diabetes the risk is increased (which is about twice the risk in the general population) due to the inferior quality of bone. Bone fragility in type 2 diabetes, which is not reflected by bone mineral density, depends on bone quality deterioration rather than bone mass reduction **(Murray CE and Coleman CM, 2019)**. Thus, surrogate markers and examination methods are needed to replace the insensitivity of BMD in assessing fracture risks of T2DM patients **(Burge R et al., 2007).** One of these methods can be trabecular bone score. The aim of the paper is to present the present state of scientific knowledge about the osteoporosis risk in diabetic patients. The review also discusses the possibility of problematic using the study conclusions in real clinical practice **(Seeman E et al., 2006).**

Objectives

- Investigate the relationship between diabetes and osteoporosis, focusing on shared risk factors and underlying mechanisms.
- Evaluate bone density in diabetic patients, particularly those treated with Thiazolidinediones drugs, to assess their impact on bone health.
- Identify and analyse risk factors associated with the development of osteoporosis, including lifestyle factors, medical conditions, and medication use.
- Examine the progression of osteoporosis across different age groups, comparing male and female populations to understand gender-specific patterns of bone loss and fracture risk.
- Assess the effectiveness of current management strategies for preventing and treating osteoporosis in individuals with diabetes, including lifestyle interventions and pharmacotherapy.
- Explore potential novel interventions or therapeutic targets for mitigating bone loss and fracture risk in diabetic patients with osteoporosis, aiming to improve overall bone health outcomes.

Research Methodology

- Type of Research: Qualitative Research (Survey)
- Target sample: Individuals aged 30 to 60, with a few participants from the teen and kid age groups
- Type of Sampling: Probability sampling
- Sample Size: 100
- Duration of Survey: 46 days
- Tools Used: Questionnaires

Description

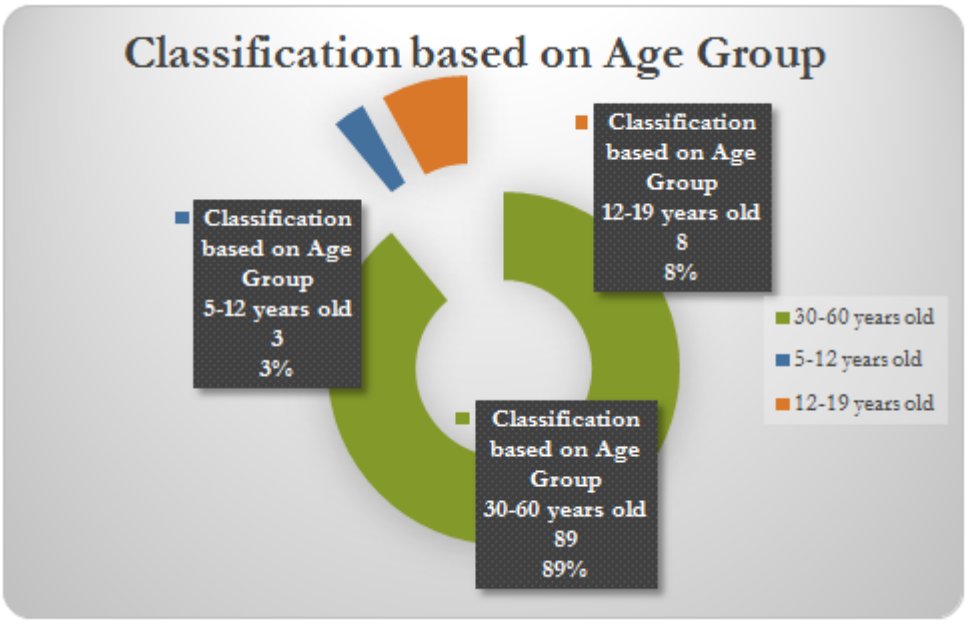
This qualitative survey aimed to explore perceptions and experiences related to diabetes and osteoporosis among individuals aged 30 to 60, with a small representation from the teen and kid age groups. Probability sampling ensured diverse perspectives within the target population. Conducted over 46 days from 2023 to 2024, the survey employed questionnaires to gather insights into participants' knowledge, attitudes, and behaviors regarding the two conditions. Recruitment channels included community centers, healthcare facilities, and online platforms. With a sample size of 160, thematic analysis will be employed to identify common themes and variations in responses, yielding rich qualitative insights.

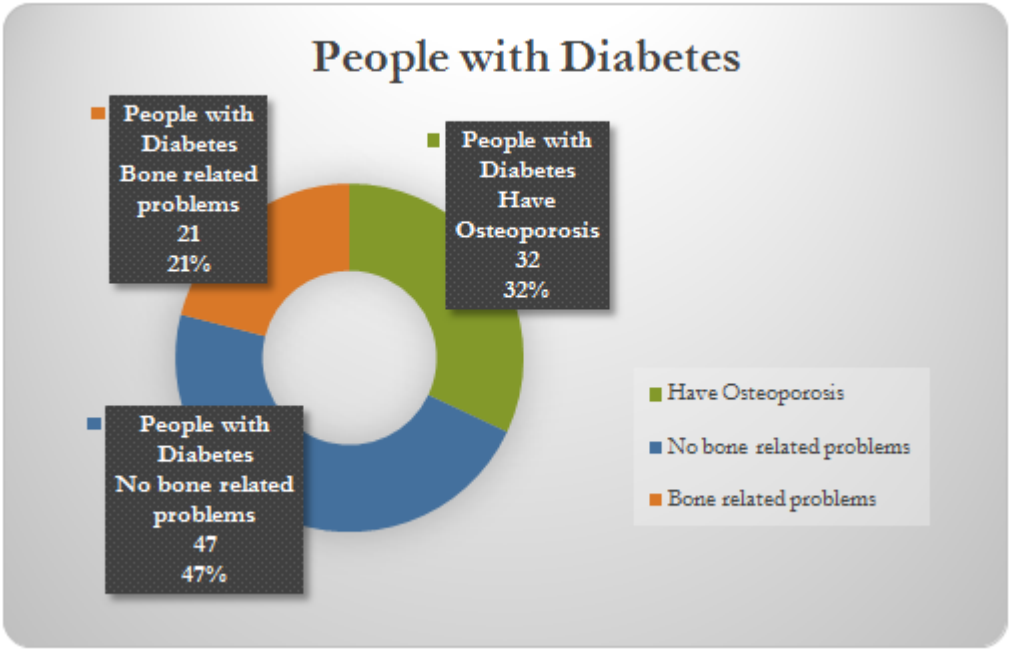
Result

The present study was conducted to study the relationship between diabetes and osteoporosis. The present study was conducted on 100 people with diabetes. The study reveals that 32% have been diagnosed with osteoporosis and 21% are having some bone related problems.

The sample consisted of 46 males and 44 females, out of which there are 3 in the age group of 5 to 12 years old, 8 are in 12 to 19 years old and the rest are aged 30 to 60. The study reveals no significant difference in level of awareness about Right to information between males and females.

Our full team including Priyanka, Sapna, Ravinder, Bhanu, and Aditya have commenced a survey for which we went to hospitals in rural places that are near Sohna where we met several people of different age groups and provided them with a questionnaire and asked them to fill that. We have to communicate with them in their language. Hence, we did about 160 people surveys and we were surprised by the responses as the majority of them were diabetic or pre-diabetic.





Discussion

In conclusion, this study sheds light on the complex interplay between diabetes and osteoporosis, highlighting the need for further research and integrated approaches to prevention and management. Despite the limitations inherent in the study design, including sample size and duration, the findings provide valuable insights into the perceptions and experiences of individuals within the target age range. The observed prevalence of diabetes and osteoporosis underscores the importance of early detection, lifestyle interventions, and targeted management strategies to mitigate the burden of these chronic conditions.

The significant association between diabetes and osteoporosis warrants attention from healthcare professionals and policymakers alike. Efforts to promote bone health and glycaemic control should be multifaceted, encompassing education, lifestyle modifications, and access to appropriate healthcare services. Additionally, interventions tailored to specific age groups and risk factors may be necessary to address the diverse needs of the population.

Moving forward, longitudinal studies are needed to elucidate the temporal sequence of diabetes and osteoporosis onset and explore the effectiveness of interventions in reducing fracture risk and improving bone health outcomes. Furthermore, research focusing on diverse demographic groups and geographic regions can provide a more comprehensive

understanding of the global burden of these conditions and inform targeted public health initiatives.

In conclusion, addressing the complex relationship between diabetes and osteoporosis requires a collaborative effort involving healthcare professionals, policymakers, and the community. By implementing evidence-based strategies and fostering awareness, we can work towards reducing the impact of these chronic conditions and improving the quality of life for individuals affected by diabetes and osteoporosis.

Limitations

Although we're learning more about how diabetes and osteoporosis are connected, there are still gaps in our understanding. We need studies that follow people over time to see which condition comes first and how they affect each other. Also, we don't know enough about which diabetes medicines might help protect bones or which lifestyle changes work best for people with both conditions. By filling in these gaps, we can create better ways to prevent and treat both diabetes and osteoporosis for people who have them together.

Limitations of the study include the reliance on self-reported data, potential sample bias due to the limited representation of younger age groups, and the cross-sectional design, which restricts causal inference. Additionally, the study's short duration and voluntary participation may have implications for generalizability and response bias. Here are some limitations that we have faced:

- **Limited Sample Diversity:** The study primarily focused on individuals aged 30 to 60, with only a small representation from the teen and kid age groups, potentially limiting the generalizability of findings to younger age cohorts.

- **Self-Report Bias:** The data collected relied on self-reported information through questionnaires, which may be subject to recall bias or social desirability bias, leading to inaccuracies or overestimation of certain behaviors or attitudes.

- **Cross-Sectional Design:** The study utilized a cross-sectional design, which only provides a snapshot of participants' experiences and perceptions at a single point in time, limiting the ability to establish causal relationships or observe changes over time.

- **Limited Generalizability:** The use of probability sampling may have restricted the generalizability of findings beyond the specific

demographic characteristics and geographical location of the study population, particularly if the sample is not representative of the broader population.

- **Potential Response Bias:** Participation in the survey was voluntary, which may have introduced selection bias, with individuals who are more interested or knowledgeable about the topic being more likely to respond, potentially skewing the results.
- **Lack of Longitudinal Data:** The study's duration of 46 days limited the ability to capture long-term trends or changes in participants' perceptions and behaviours related to diabetes and osteoporosis over time, highlighting the need for future longitudinal research in this area.

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Study on the Health Information and Awareness Communicated with Working Women on Vitamin D and Calcium Deficiency

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Abstract

Calcium and vitamin D are essential nutrients for overall health, with deficiencies in either leading to health problems like osteoporosis and muscle weakness. Understanding the interplay between these nutrients is crucial, as it may provide insights into potential interventions for improving health outcomes. However, the relationship between calcium and vitamin D levels may vary across different demographic groups, such as age, gender, geographical location, and nutritional habits.

Therefore, conducting a correlational study among individuals from a specific population or demographic subgroup can help elucidate these associations. Present study focused on working female for the awareness of vitamin D and Calcium intake as well as corelation between associated symptoms. We are found that educated working females were aware of vitamin D and calcium, but less educated females were not aware of their dietary requirements. Factors such as age, exposure to sunlight, and non-animal foods can affect vitamin D and calcium deficiency symptoms.

Introduction

Calcium and vitamin D are essential nutrients that play crucial roles in maintaining overall health and well-being. Calcium is integral to bone health, muscle function, and nerve transmission, while vitamin D facilitates calcium absorption and contributes to immune function and cellular regulation. Deficiencies in either of these nutrients can lead to a range of health problems, including osteoporosis, muscle weakness, and increased susceptibility to infections.

In recent years, there has been growing interest in understanding the interplay between calcium and vitamin D levels and their implications for health outcomes among individuals. Several factors contribute to this interest, including the prevalence of inadequate intake or low levels of these nutrients in

various populations, as well as the potential health benefits associated with optimizing calcium and vitamin D status.

While previous research has explored the individual effects of calcium and vitamin D on health, relatively fewer studies have examined their combined impact or the correlation between their levels within the same individuals. Understanding this correlation is important, as it may shed light on the synergistic effects of these nutrients and provide insights into potential interventions for improving health outcomes.

Moreover, the relationship between calcium and vitamin D levels may vary across different demographic groups, such as age, gender, geographical location, and dietary habits. Therefore, conducting a correlational study among individuals from a specific population or demographic subgroup can help elucidate these associations and inform targeted interventions tailored to the needs of at-risk groups.

In light of these considerations, the present study aims to investigate the correlation between calcium and vitamin D levels and their association with various health outcomes among individuals in [insert specific population or demographic group]. By examining the relationship between these nutrients and health outcomes, this research seeks to contribute to our understanding of the importance of calcium and vitamin D in promoting optimal health and inform strategies for improving nutritional status and overall well-being in the target population.

Calcium and Vitamin D Metabolism

Calcium and vitamin D metabolism are closely intertwined processes in the human body, working together to maintain calcium homeostasis and support various physiological functions. Here's an overview of how calcium and vitamin D metabolism interact:

- **Vitamin D Synthesis:** Vitamin D is primarily synthesized in the skin upon exposure to ultraviolet B (UVB) radiation from sunlight. Specifically, UVB radiation converts 7-dehydrocholesterol in the skin into previtamin D3, which then undergoes thermal isomerization to form vitamin D3 (cholecalciferol).

- **Dietary Sources:** Vitamin D can also be obtained from dietary sources such as fatty fish (e.g., salmon, mackerel), fortified foods (e.g., milk, orange juice, cereals), and supplements.



Figure: Sources of Vitamin D

- **Activation:** Inactive vitamin D obtained from sunlight or diet undergoes two hydroxylation steps for activation. The first hydroxylation occurs in the liver, where vitamin D is converted into 25-hydroxyvitamin D [25(OH) D], also known as calcidiol.

  The second hydroxylation occurs primarily in the kidneys but can also occur in other tissues. This step converts 25(OH)D into its active form, 1,25-dihydroxyvitamin D [1,25(OH)2D], also known as calcitriol.

- **Calcium Absorption**: Active vitamin D, calcitriol, plays a crucial role in calcium metabolism by promoting the absorption of dietary calcium in the intestines. It upregulates the expression of calcium-binding proteins and calcium transporters, facilitating calcium absorption across the intestinal epithelium.

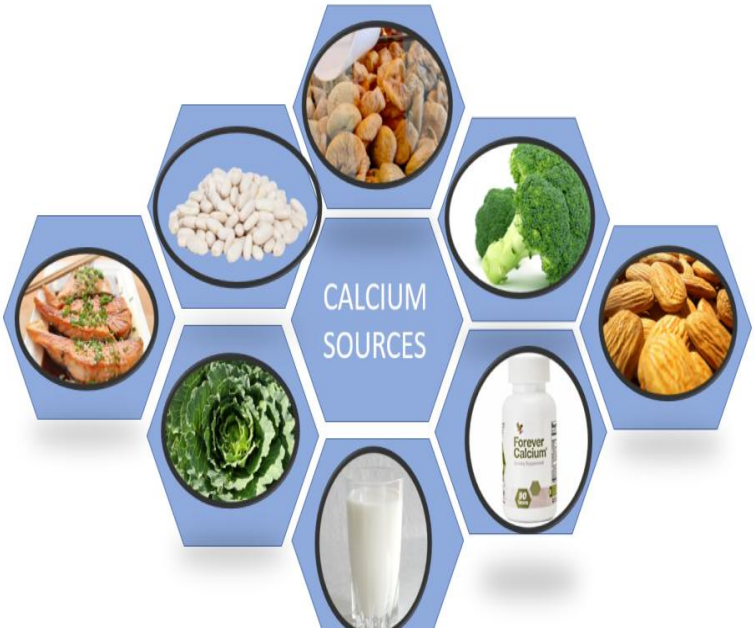


Figure: Sources of Calcium

- **Bone Health**

Calcitriol also regulates calcium and phosphate metabolism in bone tissue. It stimulates osteoclast activity, promoting bone resorption, which releases calcium and phosphate into the bloodstream.

Additionally, calcitriol stimulates osteoblast activity, supporting bone formation and mineralization.

- **Regulation**

Parathyroid hormone (PTH) and calcitonin also play significant roles in calcium and vitamin D metabolism. PTH, released in response to low blood calcium levels, stimulates the production of active vitamin D in the kidneys, enhances intestinal calcium absorption, and promotes bone resorption to maintain blood calcium levels.

Calcitonin, produced by the thyroid gland, acts in opposition to PTH by inhibiting bone resorption and promoting calcium deposition in bones, thereby lowering blood calcium levels.

Overall, the interplay between calcium and vitamin D metabolism is essential for maintaining calcium homeostasis, bone health, muscle function, and overall physiological well-being. Deficiencies or imbalances in either nutrient can lead to various health problems,

including bone disorders such as osteoporosis and rickets. Therefore, ensuring adequate intake of both calcium and vitamin D is crucial for optimal health.

Table 1: (Guideline for intake of calcium and vitamin D (Kilim et al., (2018)

	Calcium				Vitamin D			
	Women		Men		Women		Men	
Age	RDA, mg/day	Upper intake Level	RDA, mg/day	Upper intake Level	RDA, IU/day	Upper intake Level	RDA, IU/day	Upper intake Level
19-50	1,000	2,500	1,000	2,500	600	4,000	600	4,000
51-70	1,200	2,000	1,000	2,000	600	4,000	600	4,000
≥ 70	1,200	2,000	1,200	2,000	800	4,000	800	4,000

RDA=recommended dietary allowance

Role of Calcium and Vitamin D in Female Health

Calcium and vitamin D play crucial roles in female health at every stage of life. Here's how they contribute to various aspects of women's health:

- **Bone Health**

Calcium is a key component of bone tissue, providing strength and structure. Adequate calcium intake, along with vitamin D, is essential during childhood and adolescence to support optimal bone development and peak bone mass acquisition.

In adulthood, maintaining sufficient calcium and vitamin D intake is crucial for preserving bone density and reducing the risk of osteoporosis, a condition characterized by weak and brittle bones, which is more prevalent in women, especially after menopause.

Vitamin D facilitates calcium absorption in the intestines and helps regulate calcium levels in the blood, supporting overall bone health.

- **Menstruation and Pregnancy**

During menstruation, women lose calcium through blood loss. Adequate calcium intake becomes especially important during this time to offset calcium loss and maintain bone health.

In pregnancy, calcium is vital for the development of the baby's bones, teeth, muscles, and nerves. Vitamin D is necessary for proper fetal bone development and may reduce the risk of complications such as preeclampsia.

- **Menopause:** After menopause, women experience a decline in estrogen levels, which accelerates bone loss. Calcium and vitamin D become even more critical during this time to help maintain bone density and reduce the risk of osteoporosis and fractures.

- **Muscle Function:** Calcium is essential for muscle contraction and relaxation. Adequate calcium intake helps prevent muscle cramps and spasms, which can be particularly beneficial for women who engage in regular physical activity or exercise.

- **Heart Health:** Some research suggests that both calcium and vitamin D may play a role in cardiovascular health. Adequate calcium intake has been associated with a lower risk of hypertension, while vitamin D deficiency has been linked to an increased risk of cardiovascular diseases.

- **Mood and Mental Health:** Emerging evidence suggests that vitamin D may play a role in mood regulation and mental health. Low vitamin D levels have been associated with an increased risk of depression and other mood disorders, which are more prevalent in women.

Overall, maintaining optimal levels of calcium and vitamin D is essential for promoting bone health, muscle function, cardiovascular health, and overall well-being in females across all stages of life. A balanced diet rich in calcium-containing foods, adequate sun exposure for vitamin D synthesis, and, if necessary, supplementation under the guidance of a healthcare provider, can help ensure women meet their nutritional needs for these essential nutrients

Literature Review

- Sofi et al., (2017). Indian women of reproductive age are highly likely to be deficient in vitamin D, regardless of their socioeconomic status. These women might be more susceptible to osteoporosis and problems connected to pregnancy in the future. Given the dearth of naturally occurring foods high in vitamin D in the nation, these women should place a higher premium on food supplementation or fortification with vitamin D as well as getting enough sunshine exposure. To support the results of the current study, future research with a bigger sample size is required to evaluate the vitamin D status of women in the reproductive age group across the nation.

- Selvarajan et al., (2017) Since sunlight is the main source of vitamin D, it was long believed that a nation like India, which receives plenty of sunlight throughout the year, would not have a vitamin D shortage. On the other hand, research conducted on the Indian people revealed a varied picture. Reduced synthesis of vitamin D due to darker skin, sunscreen use, indoor lifestyle, lower consumption of vitamin D-rich foods, etc., is one of the causes of vitamin D insufficiency among Indians.[32] Thus, it is being proposed that the treatment of vitamin D deficiency among Indians should involve a widespread usage of vitamin D supplements. Additionally, it is advised to raise public knowledge about the prevalence of vitamin D deficiency and the precautions that should be taken to prevent it, such as increasing exposure to sunlight, eating a diet high in vitamin D, and taking supplements of vitamin D if necessary. Through governmental healthcare programs, recommendations are made about the fortification of food with vitamin D.

- Kambal et al., (2023) A study conducted at Jazan University in Saudi Arabia found that female students have limited knowledge about vitamin D deficiency, which is linked to various diseases. The study found that most participants were unaware of its benefits and the importance of sunlight for maintaining vitamin D levels. However, only 43.1% identified decreased intake of vitamin D-rich foods as a cause of vitamin D deficiency. Most respondents preferred exposure to sunlight and used vitamin D supplements, but only 39.2% had ever examined their vitamin D status. The findings suggest the need for cognitive interventions.

- Da Silveira et al., (2022) A study aimed to estimate the prevalence of vitamin D and calcium deficiencies and associated risk factors in Brazilian women of childbearing age. Results showed a high prevalence of vitamin D deficiency and insufficiency, with insufficiency affecting over half of these women. The South region had the highest prevalence of vitamin D deficiency and insufficiency. However, the study did not assess the prevalence and factors associated with calcium deficiency.

- Aparna et al., (2018) A fat-soluble vitamin that is essential to human physiology is vitamin D. Globally, vitamin D insufficiency is common. Aside from the well-known skeletal problems, this shortage has numerous undiscovered implications. Our goal in doing this study is to provide an overview of the body of research on vitamin D status in India and to gauge the scope of the issue. Between 40% and 99% of people have vitamin D deficiency; most studies found that between 80% and 90% of people had the condition. It was common in high-risk groups as well as all age groups. We can envision the burden that a vitamin D deficiency

would bring to our nation, given the research being done on the effects of it on autoimmune illnesses, cardiovascular diseases, cancer, and tuberculosis.

- Ravinder et al., (2022) Pregnant women select low- to moderate-intensity physical activity, especially in the final trimester of their pregnancy. It is commonly known that biological factors like as age, the number of pregnancies, and the trimester have a substantial impact on a pregnant woman's overall physical activity level. The current study's findings support the notion that pregnant women should lead an active lifestyle, and that more public knowledge of the advantages of physical activity is necessary to encourage pregnant women to engage in physical activity for the healthy development of the fetus. It's arguable whether physical activity has any benefit for expectant mothers. The majority of studies indicate a correlation between women's levels of physical activity and their vitamin D status.

- Syeda et al (2020) The study's conclusions demonstrate that the participants' mean calcium intake (mean consumption 324.0±143.5) is much lower than the required amounts, which is also supported by the results of their bone mineral density test (35%).The majority of individuals were maintaining an ideal BMI, while 23.5% fell into the obesity group, according to the anthropometric measurements. A study by Kim et al. demonstrates that among participants of normal weight, higher bone mineral density is associated with a higher percentage of body fat. Mohammed Reza Salamat et al.'s other investigation revealed a relationship between osteopenia and BMI in males who were overweight or obese and those who were normal weight.ElevenPeople who are overweight, thin, or who have lost 10% or more of their body weight may be susceptible to osteoporosis. Therefore, regardless of BMI, individuals are susceptible to low bone mineral density. In general, individuals who are obese, as determined by their body fat percentage, may be susceptible to osteoporosis.

- Ahmed et al., (2023) Having enough calcium is essential for a healthy life, especially as one ages. A lack of it causes a variety of metabolic diseases, including osteoporosis, abnormalities in the teeth, cataracts, and changes in brain function. Because females have higher turnover of calcium throughout their life cycle—particularly during pregnancy and lactation—these deficits are more noticeable in them. A key function of vitamin D is in the metabolism of calcium. Recent scientific research has connected calcium to a number of metabolic diseases that affect women, such as multiple sclerosis, breast cancer, premenstrual dysphoric disorder,

obesity, hypertension, and polycystic ovary syndrome (PCOS). This review covers various metabolic diseases in women, specifically focusing on deficiencies in calcium and vitamin D. The goal of this review article is to summarize and expound on the information that is currently accessible about the global occurrence. This review covers various metabolic diseases in women, specifically focusing on deficiencies in calcium and vitamin D. In order to provide a foundation for developing strategies and population-level scientific studies to appropriately boost calcium intake and position where necessary, this review article aims to present and elaborate on the data currently available regarding the worldwide occurrence of insufficient calcium consumption in females and related health risks.

- Khazai et al., (2008) For ideal skeletal health, calcium and vitamin D are crucial for the correct mineralization of bone. The protection of autoimmune disorders, lowered risk of cancer, avoidance of falls, enhanced immunity, prevention of hypertension, and diabetes are some of the other advantages of vitamin D. Screening for and treating vitamin D insufficiency should become standard practice, especially in patients with osteoporosis and/or autoimmune illnesses, given the high prevalence of vitamin D insufficiency in the general population and in patients with rheumatologic diseases. To find out if vitamin D supplementation can lower the risk of extra skeletal illnesses, prospective trials must be carried out.

- Dinizulu et al., (2011) This study demonstrates that vitamin D deficiency is quite prevalent among older women who live in institutions as well as in the community. Among the individuals admitted to institutions, there was a greater incidence of vitamin D deficiency. There was no obvious biochemical advantage to taking calcium supplements along with vitamin D. Even though the group receiving vitamin D alone had a mean baseline vitamin D level that was lower than the group receiving a combination vitamin D and calcium supplement, a greater percentage of this group nonetheless attained normal vitamin D levels following therapy. After therapy, neither group's levels of calcium, PTH, phosphate, or alkaline phosphatase changed in a way that was statistically significant. Despite the fact that the group of nursing homes receiving only vitamin D had a somewhat higher mean lifespan.

- Nidhi et al (2018) The production and maintenance of bones, as well as the absorption of calcium, depend on vitamin D. It was believed that the ubiquity of food-fortifying initiatives had eliminated vitamin D insufficiency; however, the condition is still surprisingly widespread and

seems to be becoming worse in many regions of the world. In this study, we discovered that housewives had a significant vitamin D3 shortage, whereas working women had insufficiencies.

- In this meta-analysis demonstrated that among older persons living in the community, there was no significant correlation between calcium, calcium plus vitamin D, or vitamin D supplementation and a decreased incidence of hip, nonvertebral, vertebral, or total fractures. These findings remained unchanged by sensitivity analyses that eliminated low-quality trials and studies that only included people with certain medical problems. Additionally, these findings held true regardless of the baseline serum 25-hydroxyvitamin D concentration, sex, fracture history,

- Sosnowski et al., (2011) this study demonstrates that the dietary habits of the countries under investigation are dominated by unfavorable tendencies. Overeating was noted in every instance, and as a result, obesity and overweight were common.
  The amount of calcium obtained from food was adequate, although it's interesting to note that individuals between the ages of 14 and 18 consume less calcium than is advised. Given that this is the important age for bone formation, it is highly unfavourable.

Research Gaps

There was no such study conducted related to Calcium and Vitamin D deficiency and their awareness among working females of various age group.

Objectives

- Identifying the status of knowledge related to Vitamin D and Calcium deficiency among target population
- Correlating the Data with obtain for calcium and vitamin D
- Estimating the symptoms of deficiency among working females of various age gorup.

Research Methodology

- Type of Research: Survey
- Target sample: Inside GD Goenka university and nearby
- Type of Sampling: Random sampling
- Sample Size: Approx. 100
- Tools to be used: Google Form, Excel sheet, Pie chart, Statistic Chart, Bar Chart, MS word

Findings

In this study, it was reported that educated working females had knowledge about vitamin D and calcium, but less educated working females were not aware of the importance of their dietary requirements. We found that food habits, sun exposure, and lifestyle affect the nutritional requirements of vitamin D and calcium. The age group above 40 is more susceptible to deficiency symptoms, especially after the age of 45. Working females are less exposed to sunlight, which affects vitamin D deficiency symptoms in their bodies. Breastfeeding mothers are more affected by symptoms associated with calcium metabolism. Among all the target population, 75% of females experienced deficiency symptoms. 77% of the of the female population was vegetarian, which indicates that non-animal foods increase the prevalence of symptoms and disorders associated with vitamin D and calcium. 37% of the target population receives little sunlight, and approximately 19% is not exposed to enough sunlight.

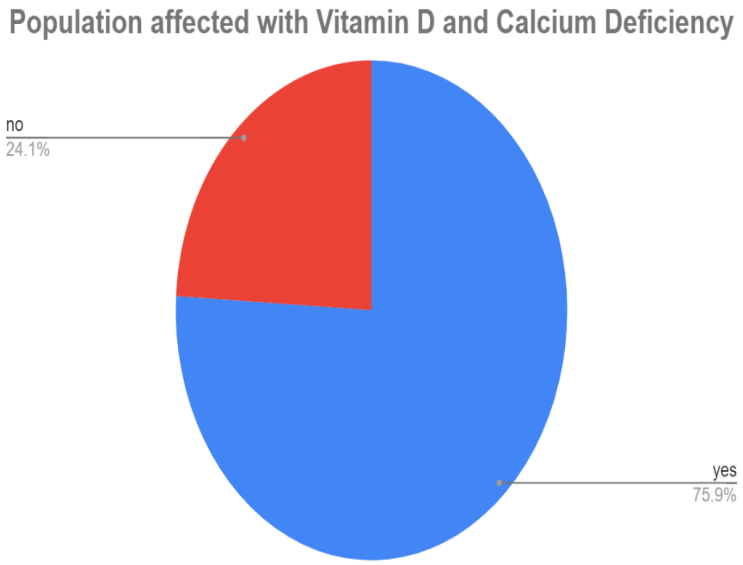


Chart 1: Representation of female population affected with Vitamin D and Calcium Deficiencies.

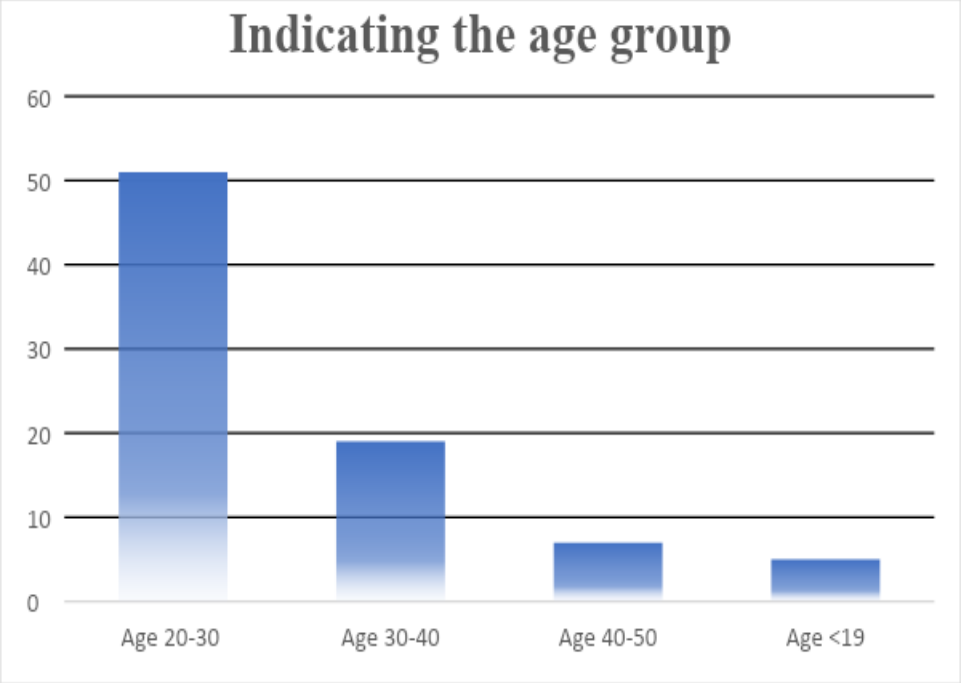


Chart 2: Representing the different age groups of people all females involved in research.



Chart 3: Representing the dietary practices followed by the People (female) involved in research.

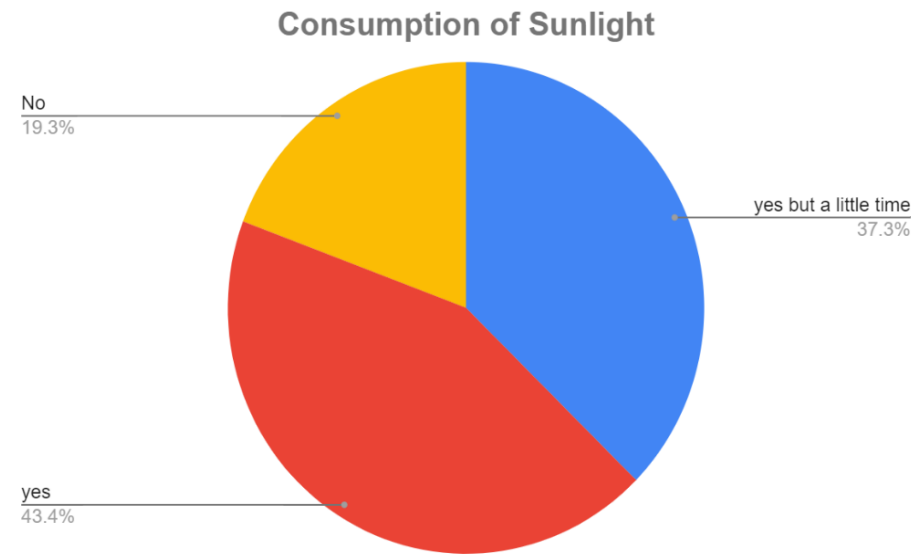


Chart 4: Representing the females consuming enough Sunlight as natural sources.

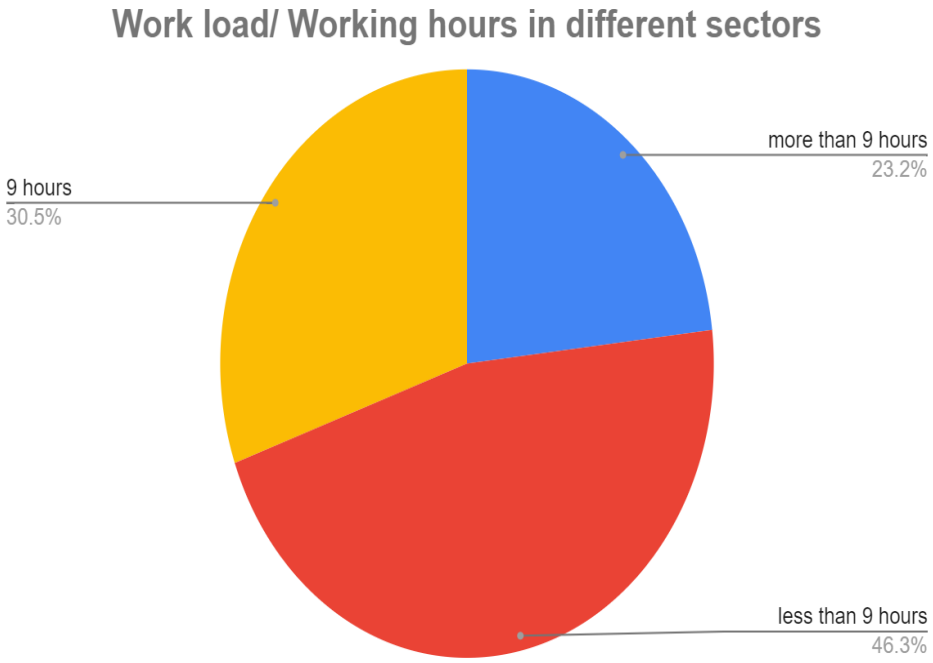
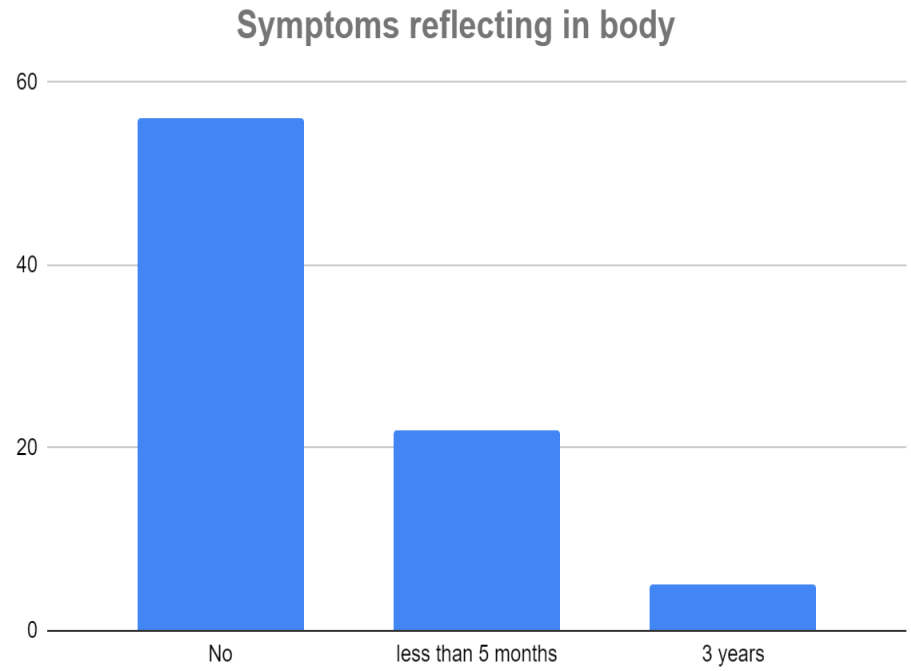


Chart 5: Representing the working hours of female involved in this particular research.



Limitation

To gather samples, a number of obstacles have to be overcome (using survey method). The time allotted to social interactions in order to produce accurate results. Different work profiles, dietary habits, and life stages are additional ways to get accurate data for research and comparison.

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Study on the Effects of Intensive Labour Job on the Respiratory System and Respondents' Understanding of the ABG Diagnosis

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Abstract

The pH scale indicates the acidity or alkalinity of blood, and blood homeostasis is essential for preserving good bodily health. Blood has a pH range of 7.35 to 7.45, making it inherently basic. Blood pH is usually maintained by the body at or around 7.40. Blood acidity rises as the body's levels of acidic chemicals rise as a result of increased intake or production. In contrast, blood alkalinity increases when the body's basic chemical levels drop. By releasing carbon dioxide from the lungs, the body controls the pH of the blood. Cells continuously produce carbon dioxide, a waste product that is somewhat acidic and leaves the cell to enter the circulation. The blood's pH decreases as carbon dioxide builds up, and the brain regulates breathing depth and pace to regulate the amount of carbon dioxide expelled. The study is around the level of understanding of intensive labor job people struggling with respiratory conditions and about ABG test.

Keywords: PO_2 (Partial pressure of Oxygen), PCO_2 (Partial pressure of Carbon Dioxide), pH (power of hydrogen), HCO_{3-} (bicarbonate ions),blood gas analysis, H^+ ions, pathological conditions, respiratory system, asthma, Chronic Obstructive Pulmonary Diseases, labour job, ABG (Arterial Blood Gas).

Introduction

Blood collected from any part of the circulatory system (capillary, vein, or artery) is suitable for a "blood gas analysis". Blood extracted from an artery is particularly assessed by an arterial blood gas (ABG) test. The partial pressures of carbon dioxide (PaCO2) and oxygen (PaO2) in a patient are measured using an ABG analysis. While PaCO2 measures ventilation (acute or chronic respiratory failure), PaO2 measures oxygenation. PaCO2 is impacted by acid-base state, hyperventilation (rapid or deep breathing), and hypoventilation (slow or shallow breathing). While non-invasive methods such as pulse oximetry and end-tidal carbon dioxide monitoring can evaluate ventilation and oxygenation, ABG analysis is the ideal standard [1].

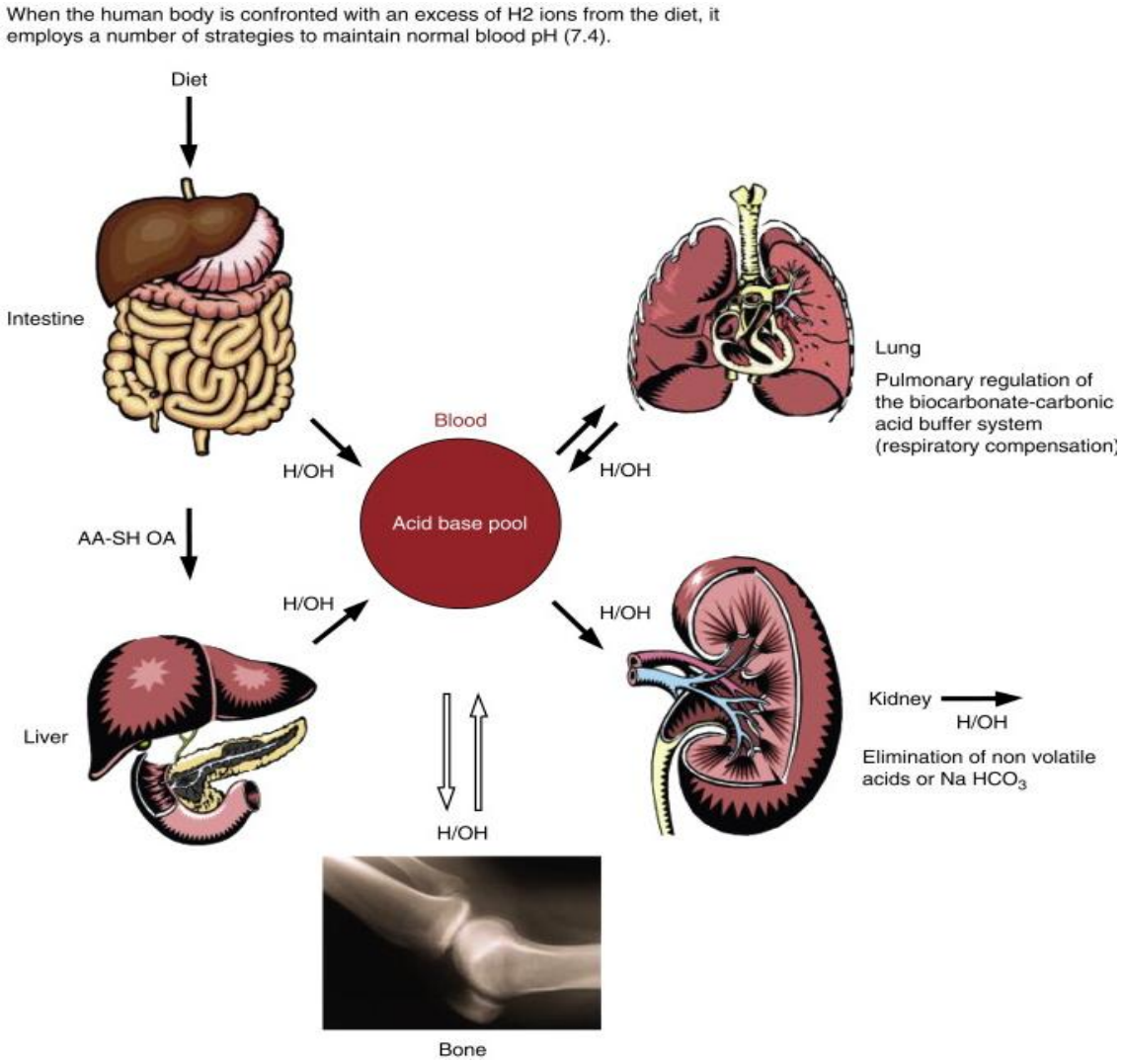


Figure: The organs associated with the acid base Balance homeostasis.

Acid-base balance (ABG) analyzers measure pH and PaCO2 to assess acid-base balance. The Hasselbach equation is used to calculate serum bicarbonate (HCO3) and base deficit, but it often yields a difference due to the equation's failure to account for blood CO2. A strong alkali is used to detect HCO3, which liberates all CO2 in serum. A higher disparity between ABG and measured value may be detected, especially in severely ill individuals. [3]. As a result of an intracranial hemorrhage, for example, central nervous system interstitial fluid (ISF) may acidify. The ISF acidosis prompts the respiratory control centre to trigger hyperventilation, which is a required compensation for preserving neuronal pH from acidification, but it comes at the expense of peripheral respiratory alkalosis [4]. Normalization of peripheral blood pH may result in the removal of an essential component of brain pH control [4,5].

There are two different types of fluids which help in maintenance of the acid base balance:

- Intracellular Fluid
- Extracellular Fluid

i.

Extracellular fluid (ECF) plays critical roles in importance of pH and lactate in T cell activation in immunological function, extracellular matrix synthesis, and angiogenesis is primarily due to the ease of monitoring accessible blood as a surrogate for tissue health. Protein synthesis, intermediate metabolism, cell development, and reproduction all rely on maintaining intracellular fluid (ICF) pH [6,7]. The speed with which accessible blood may be measured is what lends it such importance as a proxy for determining tissue health. Protein synthesis, intermediate metabolism, cell development, and reproduction all rely on maintaining intracellular fluid (ICF) pH. Although much is known about the systems that regulate it [**8,9**]. ICF acid-base balance is more difficult to assess technically, is diverse across subcellular compartments, and, because different organs regulate pH with varying degrees of precision, a single set of blood measurements cannot correctly reflect the health of all organs. Methods for measuring in vivo cell pH, as well as pH in different organs under different situations, can greatly advance our understanding and management of human acid-base disorders [10, 11]. The ECF accounts for one-third of total body water, whereas the ICF accounts for two-thirds of total body water. The ECF is further subdivided into intravascular plasma volume, interstitial fluid (ISF), and transcellular fluids. The ECF contains a transcellular gap that is bordered by epithelial cells. The gastrointestinal tract, renal tubular lumen (urinary space), and sweat gland ducts are among examples. Because these compartments are exposed to the outside world, their contents are lost from the body to varying degrees in health and disease. Other transcellular fluids or spaces include cerebral fluid, pleural and peritoneal spaces, however because these are not exposed to the outside environment, they often reflect rather than define ECF acid-base state [12, 13].

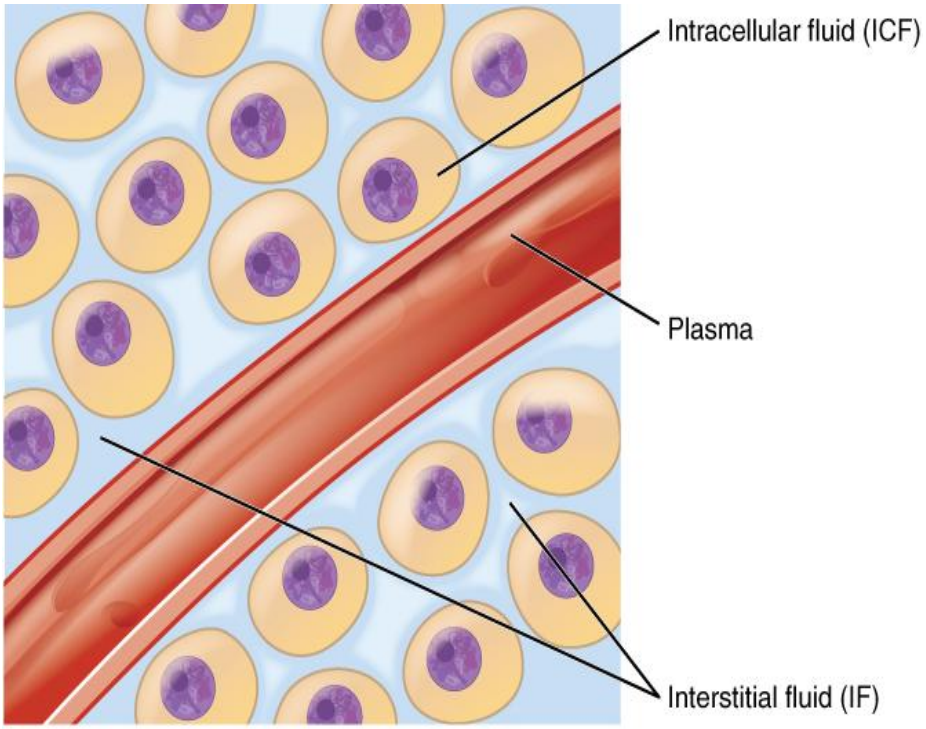


Figure: The Functions of Intracellular Fluid and Interstitial Fluid.

Lungs play a crucial role in maintaining acid base balance, which can be dangerous in patients with cardiopulmonary problems. Treatment options are essential, as acid-base abnormalities can significantly reduce cardiopulmonary function, even in those without underlying heart or lung disease. [14]. The study of acid-base shifts in the body's cardiovascular and pulmonary systems is crucial for understanding pathophysiological mechanisms. These systems, known as the "oxygen transport system," include ventilation, pulmonary perfusion, diffusion, and the oxygen-carrying capacity of haemoglobin. Understanding the effects of pH variations on these phases is essential for comprehending the body's oxygen requirements and the overall health of its tissue cells. [15]. The lungs compensate for metabolic disturbances, and the kidney compensates for pulmonary disturbances; however, signals to the lung alter ventilation control in respiratory illnesses, whereas metabolic disorders necessitate renal responses [16]. Acute respiratory acidosis is a condition where CO2 increases the central ventilatory response, leading to hypoventilation and hypercapnia. Metabolic abnormalities compensate for this, and for metabolic acidemia to occur, lost bicarbonate-containing diarrhea must exceed renal ability to generate and eliminate urine ammonia. Excessive animal protein intake may not cause metabolic acidemia in patients with normal renal function or chronic kidney disease. [18, 19] . Red blood cells transport ammonia to the liver through Rh family membrane glycoproteins. Carbamoyl phosphate synthetase aids in urea cycle entry. Metabolic acidosis increases catecholamines and corticosteroids, leading to protein catabolism and

ammonia creation. Acidosis reduces ureagenesis, diverting ammonia to hepatic glutamine. [20, 21].

Respiratory acidosis, also known as alkalosis, is common in patients with lung illness, often resulting in a pH above 7.7, and those with reduced lung function may have excessive hypoventilatory responses and deficient hyperventilatory responses[22]. The normal lung can achieve minimal pCO2, but compensatory mechanisms for metabolic acidosis may not be sufficient in pulmonary illness. Severe acidosis requires treatment or ventilation to avoid rapid blood pH reductions and further acidemic insults. Patients with renal failure are more likely to develop acidemia due to limitations in ammoniagenesis. People with reduced glomerular function experience acidosis with high-protein diets, less bicarbonate-containing diarrhea, or lower organic anion acidosis [23].

The Method of Diagnosis for Acid-Base Disorders

Acid-base imbalances are diagnosed through a comprehensive history, physical examination, and laboratory tests. Low plasma bicarbonate levels indicate metabolic acidosis or respiratory alkalosis, with metabolic acidosis being the predominant disorder. [9]. Mixed disorders can be diagnosed using various findings, with empirical data used to estimate compensation, like normal respiratory compensation for metabolic acidosis based on observation.[24]. Pulmonary alkalosis can be diagnosed if real pCO2 is lower than expected, while concurrent respiratory acidosis occurs if it is higher. Chronic metabolic acidosis leads to primary hyperventilation, reducing bicarbonate concentration. A mixed metabolic disturbance is probable. [25]. A systematic approach to arterial blood gas interpretation determines abnormalities, severity, and disease type. pH and PaCO2 levels are crucial for diagnosis. Respiratory system deviations impact acid-base balance, common in patients with metabolic conditions.[28].

Review of Literature

- Gattinoni et. Al., (2018) Blood gas analysis is most likely the most commonly utilised diagnostic technique in intensive care. In reality, thorough understanding and application of arterial and pulmonary/central venous blood gas and electrolytes measurements allows for accurate interpretation of the majority of respiratory, circulatory, and metabolic derangements that can occur in critically ill patients.

- Husain et. Al., (2013) High glycolytic activity in tumour cells inhibits host immune response, with lactate dehydrogenase-A (LDH-A) being abundant.

LDH-A knockdown leads to smaller tumors and decreased myeloid-derived suppressor cells in mice.

- Casey, J. R., et al Protons, used as energy currency by eukaryotic cells, determine macromolecule charge and shape. Organelle function depends on maintaining pH, which is maintained through a dynamic balance of proton-extruding and proton-importing mechanisms in various cellular compartments.

- Lau, A. Z., et al (2017) The study explores the potential of mapping intracellular pH within the in vivo mouse heart, highlighting the potential for acute contractile depression and changes in Ca2+ signaling.

- Seifter, J. L., & Chang, H. Y. (2017) et al this study attempts to provide a fresh and complete look at acid-base balance and the illnesses that might arise as a result of it. All metabolic acid-base diseases can be examined through the lens of electrolyte losses or gains or changes in the anion gap in bodily fluids. Acid-base and electrolyte balance are intertwined not just at the biological level, but also in everyday therapeutic practise. grasp electrolyte excretion and renal compensations requires a grasp of urine chemistry.

- Pierson, D. J. (2006) et al Respiratory alterations reduce renal acid-base abnormalities' systemic effects, but renal compensation occurs slower. Common symptoms include alveolar haemorrhage and glomerulonephritis. Chronic renal failure causes pulmonary edoema, fibrinous pleuritis, calcification, and TB.

- Wanders et. Al., (1983) et al the study examined the glutamate oxidation pathway in isolated ratliver mitochondria. It found that bicarbonate significantly impacts the pathway, stimulating ammonia formation and inhibiting aspartate formation. Bicarbonate did not affect glutamate transport rate. It primarily interacts with succinate dehydrogenase.

- Shear, L., Kleinerman, J., &Gabuzda, G. J. (1965) et al Azotemia is prevalent in cirrhotic patients, especially those in hepatic coma, leading to poor prognosis. Reduced water excretion in cirrhosis-free individuals predicts renal failure. Elevations in creatinine and uric acid levels may indicate early renal failure.

- Gallagher, T. J. (1979) et al Metabolic alkalosis was discovered and verified as a cause of acute hypercapnia. As a result, weaning off mechanical ventilation was postponed. Correction of alkalosis followed by PCO2

decrease verified the compensatory mechanism during alkalosis, and weaning from intermittent obligatory breathing proceeded at an optimum rate.

- DuBose, T. D., & Hamm, L. L. (2002) The diagnosis and management of acid-base disorders in critically ill patients require precise interpretation of specific disorders, including simultaneous measurements of plasma electrolytes and arterial blood gases, and understanding of physiologic adaptations and compensatory responses.

- Tuller, M. A., & Mehdi, F. (1971) et al Three individuals experienced hypokalemic metabolic alkalosis with hypercapnia and arterial carbon dioxide tension exceeding 60 mm Hg. After proper fluid and electrolyte therapy, arterial blood gas composition returned to normal. "Compensatory" hypoventilation in metabolic alkalosis rarely occurs without lung disease.

- Gutteridge, J. M. et al During the oxygen-free period, primitive obligate anaerobes evolved to cope with solar radiation. Aerobic life processes use molecular oxygen to oxidize carbon-containing molecules, releasing energy and reducing oxygen to water. Rheumatoid arthritis patients' serum and synovial fluid have elevated ceruloplasmin levels, but lower antioxidant activity.

Research Gaps

There was no such study conducted related to respiratory conditions in person on intensive labor job and also on the knowledge or understanding of ABG analysis.

Objectives

- Identifying the different type’s labor job categories and any bad habits they follow.
- Correlating the values by the labor job categorized people and their respiratory conditions.
- Estimating the knowledge about the ABG analysis by these categorized people.

Research Methodology

- Type of Research: Survey
- Target sample: Inside university and nearby
- Type of Sampling: Random sampling
- Sample Size: Approx. 200
- Tools to be used: Google Form, Excel sheet, Pie chart, Statistic Chart, Bar Chart, MS word

Proposed Hypothesis: There are chances of people in intensive labor job with respiratory conditions and the knowledge about ABG analysis will be less.

Null Hypothesis: There is no chance of people in intensive labor job with respiratory conditions and the knowledge about ABG analysis will be less.

Findings

The study confirms that individuals working in rigorous labor may have respiratory conditions, but there is a low level of awareness about Arterial Blood Gas Test (ABG) analysis. Between 70-75% of both genders have employment in intensive labor jobs, with 60% having one or more respiratory conditions? Factors like internal and external factors impact respiratory health and many people experience different forms of respiratory disorders. Only 20-30% of the population is aware of ABG analysis, while the majority is unaware.

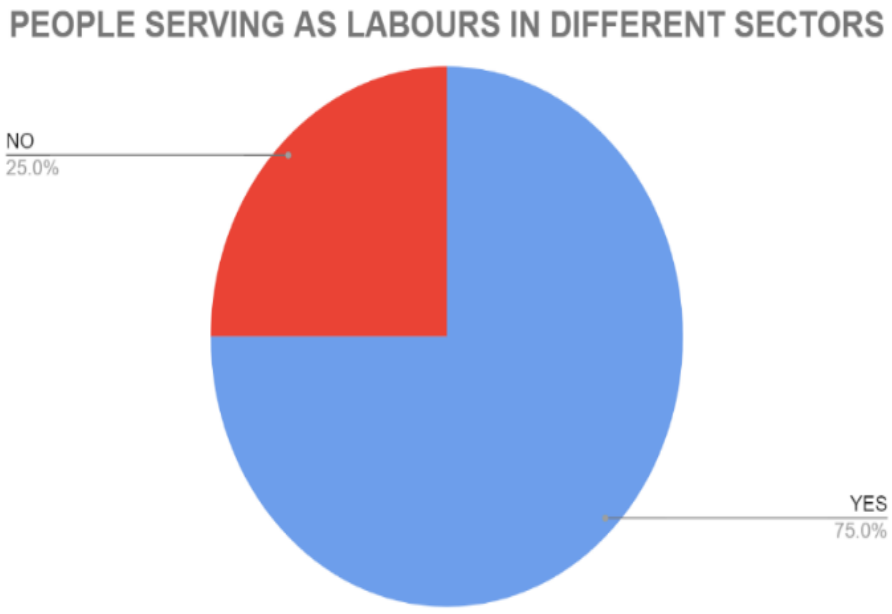


Chart 1: Representing the people with intensive labor jobs.

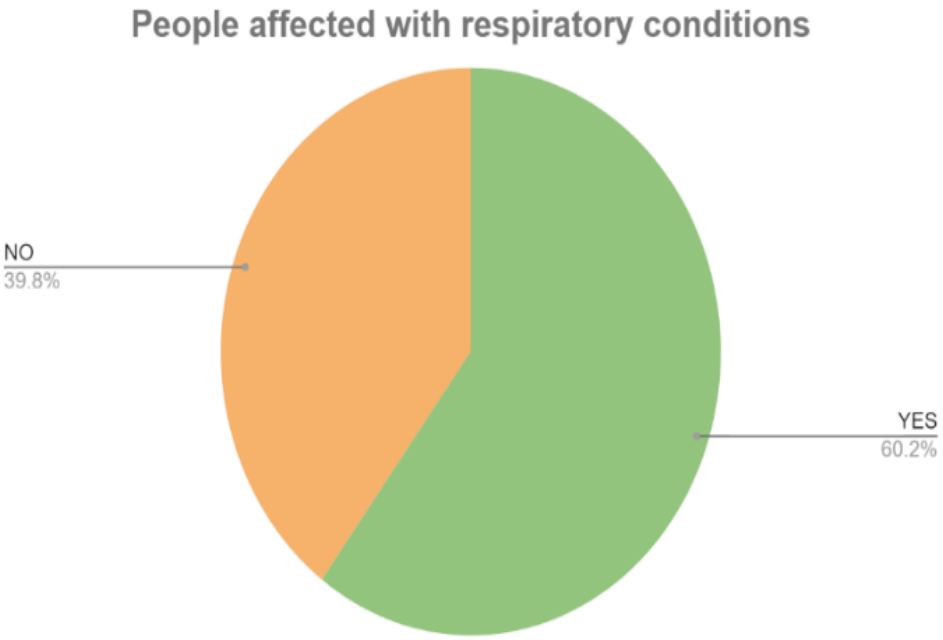


Chart 2: Representing the % of people affected with Various respiratory conditions.

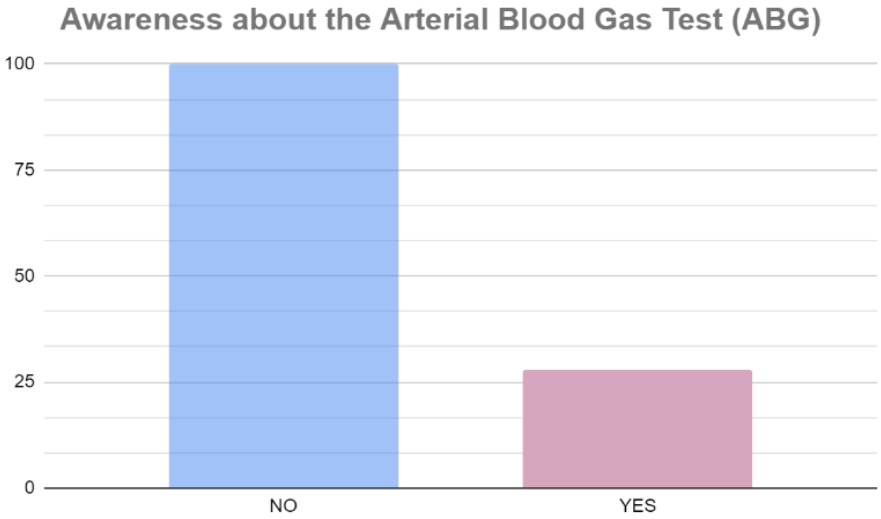


Chart 3: Represents the people aware about ABG (Arterial Blood Gas test).

Conclusion

The study reveals that 70%-75% of individuals in intensive labor jobs have respiratory conditions, with 60% having one or more. However, only 20-30% of the population is aware of Arterial Blood Gas Test (ABG) analysis. Enhancing awareness can help individuals be more vigilant about conditions supported by their workplace culture and recognize them early on.

Limitations

The study faced challenges in obtaining samples through a survey method, including time constraints, labor job types, unhealthy habits, food consumption, and climate factors like colds and coughs during winter. These factors impacted the accuracy of results and the selection of appropriate samples for the study.

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Diabetes Awareness, Risk Factors, and Health Behaviours among University Students and Staff

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Abstract

Background: Diabetes mellitus, commonly referred to as diabetes, is a chronic metabolic disorder characterized by elevated blood sugar levels resulting from either insufficient insulin production or ineffective utilization of insulin by the body. According to the International Diabetes Federation (IDF), diabetes affects approximately 463 million adults worldwide, with this number projected to rise to 700 million by 2045.

Aim: As of now, there has been limited research conducted on the awareness of diabetes at the university level, and there is a notable absence of studies focusing on sampling university students and staff. In this context, the aim of our study was to assess the level of awareness regarding diabetes risk factors and health behaviours among students and staff of GD Goenka University.

Subject & Methods: A cross-sectional study involving 710 participants was conducted, collecting data on awareness, risk factors, and health behaviours related to diabetes.

Results& Conclusion: Results revealed varying levels of awareness among participants, with staff members exhibiting higher awareness levels than students. Prevalent risk factors included family history, high blood pressure, physical inactivity, and obesity, with staff members reporting higher rates compared to students. While both groups demonstrated suboptimal adherence to a balanced diet, physical activity levels were higher among staff members. Significant associations were found between participant type and diabetes awareness, risk factors, and health behaviours. These findings underscore the importance of targeted interventions to improve diabetes awareness and promote healthier behaviours within university communities. Collaborative efforts involving healthcare professionals, educators, and policymakers are needed to address modifiable risk factors and mitigate the burden of diabetes in educational settings.

Keywords: Diabetes, awareness, risk factors, behaviour, University

Introduction

Diabetes mellitus, commonly referred to as diabetes, is a chronic metabolic disorder characterized by elevated blood sugar levels resulting from either insufficient insulin production or ineffective utilization of insulin by the body (ADA, 2020, World Health Organization [WHO], 2021). According to the International Diabetes Federation (IDF), diabetes affects approximately 463 million adults worldwide, with this number projected to rise to 700 million by 2045 (International Diabetes Federation [IDF], 2019). While traditionally considered a disease of adulthood, the prevalence of diabetes among younger populations, including university students and staff, is on the rise (Centres for Disease Control and Prevention [CDC], 2020).

Prevalence and Burden of Diabetes

The increasing prevalence of diabetes poses significant challenges to public health systems worldwide. Diabetes is associated with a range of complications, including cardiovascular disease, stroke, kidney failure, and blindness (IDF, 2019). Moreover, the economic burden of diabetes is substantial, with direct medical costs and indirect costs due to loss of productivity placing a significant strain on healthcare systems and economies globally (American Diabetes Association [ADA], 2020). The impact of diabetes extends beyond individual health outcomes to affect families, communities, and societies at large (WHO, 2021).

Unique Challenges in University Settings

University settings present a unique environment where individuals may experience significant lifestyle changes and face various health-related challenges. Factors such as academic stress, irregular schedules, sedentary behaviour, and unhealthy dietary habits can contribute to the development of risk factors associated with diabetes, such as obesity, physical inactivity, and poor dietary choices (CDC, 2020). Additionally, limited access to healthcare services and awareness programs on campus may further exacerbate the problem, leading to undiagnosed or poorly managed diabetes among students and staff (IDF, 2019).

Literature Review

DeFronzo, R. A., & Abdul-Ghani, M. (2011). Insulin resistance, impaired insulin secretion, and abnormal glucagon production are key factors in the development of diabetes type 2.

Dysregulation of adipokines, cytokines, and inflammation also contribute to the pathophysiology of the disease.

Abdulfatai B. Olokoba, (2012) Type 2 diabetes mellitus (DM) is a chronic metabolic disorder in which prevalence has been increasing steadily all over the world. As a result of this trend, it is fast becoming an epidemic in some countries of the world with the number of people affected expected to double in the next decade due to an increase in the ageing population.

LAC Meusel · 2014, Diabetes, and hypertension, as well as obesity and Alzheimer's disease, are linked to hypohydration-induced lower brain volume.

- Kaur, H. (2014) explored the genetic factors contributing to type 2 diabetes. The study highlighted specific gene variants associated with an increased susceptibility to the condition. Understanding these genetic markers is crucial for early detection and personalized intervention.

- Zhang, P (2015), lifestyle modifications emerged as a cornerstone in type 2 diabetes management. The literature review discussed the impact of diet, exercise, and behavioral changes in improving glycemic control and overall well-being.

- Cosentino, F., Grant, P. J (2020) Several studies have identified obesity, sedentary lifestyle, poor dietary habits, and genetic predisposition as significant risk factors for type 2 diabetes (Kaur, 2014). Lifestyle interventions, including weight loss, physical activity, and dietary modifications, have been shown to effectively prevent or delay the onset of diabetes in high-risk individuals.

- Cosentino et al., (2020). Diabetes type 2 is associated with various complications, including cardiovascular diseases, nephropathy, retinopathy, and neuropathy. Glycemic control, blood pressure management, lipid-lowering, and Reno protective strategies have been shown to reduce the risk of complications and improve long-term outcomes.

- American Diabetes Association. (2021). published Pharmacological approaches for managing type 2 diabetes include oral antidiabetic agents, such as metformin, sulfonylureas, and thiazolidinediones, as well as injectable therapies like glucagon-like peptide-1 receptor agonists (GLP-1 RAs) and sodium-glucose cotransporter-2 inhibitors (SGLT2 inhibitors).

Research Gap of the Study

Despite the increasing prevalence of diabetes among young adults, there is a paucity of research focusing specifically on diabetes awareness, risk factors, and health behaviours among university students and staff. Existing studies often overlook the interplay between awareness, risk factors, and health behaviours concerning diabetes within the university context (Lee et al., 2021). While some research may address one or two of these aspects individually, few studies comprehensively examine all three components and their interconnectedness among university students and staff. Understanding this holistic perspective is crucial for developing targeted interventions and health promotion strategies tailored to the needs of this population (Kandimalla et al., 2019).

Aims & Objectives

The primary aim of this study is to assess diabetes awareness, risk factors, and health behaviours among the GD Goenka University students and staff.
Specific objectives include:

- To Determine The Level Of Awareness Regarding Diabetes Among GD Goenka University Students And Staff.
- To Identify The Prevalent Risk Factors Associated With Diabetes Among The Study Population.
- To Evaluate The Health Behaviours Related To Diabetes Prevention And Management Among GD Goenka University Students And Staff.
- To Explore The Differences In Diabetes Awareness, Risk Factors, And Health Behaviours Between Students And Staff Members.
- To Provide Insights That Can Inform The Development Of Targeted Interventions Aimed At Improving Diabetes Awareness And Promoting Healthy Behaviours Within The GD Goenka University Community.

Research Questions

- What is the level of awareness regarding diabetes among GD Goenka University students and staff?
- What are the prevalent risk factors associated with diabetes among GD Goenka University students and staff?
- What health behaviours are commonly observed among GD Goenka University students and staff in relation to diabetes prevention and management?

Research Methodology

A cross-sectional study was conducted from January 23, 2024, to April 8, 2024, across all schools within the GD Goenka University, working 2 hours per day in five days per week.

Target population: A convenient sample of 710 participants (416 students 294 staff members) who met the inclusion criteria and willing to participate were recruited for the study.

Inclusion criteria

- Students and staff membersof the University.
- Any subjects agedbetween 20 to 70 years.
- Both genders.
- Whether diabetic or non-diabetic.

- **Study tools and data collection:** A convenient sample was collected from the target population during the expected period of data collection (03 months), and data was collected by a questionnaire circulated amongst the participants through google sheet which was prepared by the researchers with supervisor after extensive literature review to collect relevant data, it includes the following information:

Part A: The participant's sociodemographic factors and other related factors along with 18 knowledge questions that covering key area in awareness about diabetes mellitus including "definition, risk factors, prevention, control, management, complication, hypoglycemic symptoms identifications, plasma glucose level awareness. A scoring system was developed for each question, each correct answer was given score of (1), and each incorrect or don't know answer was given a score (0) the total score ranged from (0-18) transfer to 100% questionnaire.

Three categories were defined on basis of the score obtained by each participant:

- Insufficient knowledge awareness (if awareness score<40% of the total score).
- Moderate knowledge awareness (if awareness score 42- 60 % of the total score).
- Good knowledge awareness (if awareness score>60% of the total score).

Part B: This part consists of a questionnaire designed to screen for diabetes risk based on parameters established by the American Diabetic Association. To assess the actual risk of developing diabetes among participants, we employed a validated questionnaire provided by the American Diabetic Association in 2020. This questionnaire encompasses various factors, including age, gender, and history of gestational diabetes (for females), family history of diabetes, high blood pressure, physical activity, and body weight. The ADA risk questionnaire gathers self-reported data on these seven diabetes risk factors, categorized as follows:

- **Age:** Less than 40 years (0 points), 40-49 years (1 point), 50-59 years (2 points), or 60 years or older (3 points)
- **Gender:** Male (1 point) or Female (0 points)
- **History of gestational diabetes:** Yes (1 point) or No (0 points)
- **History of hypertension:** Yes (1 point) or No (0 points)
- **Family history of diabetes:** Yes (1 point) or No (0 points)
- **Physical activity:** Yes (0 points) or No (1 point)
- **Weight status:** Normal (0 points) or Overweight (1 point)

Each level of these risk factors corresponds to a specific score, which is then summed to provide a total score, with a maximum score of eleven (11) points. A score less than 5 indicates a low risk of diabetes, whereas a score equal to or greater than 5 suggests a high risk of undiagnosed prediabetes or type 2 diabetes.

Part C: Finally, the third part of the questionnaire was about lifestyle-related knowledge and behaviours factors with their diabetes awareness level.

Ethical consideration: This study got approval from the IDP committee of the GD Goenka University.

Data Analytics: SPSS version 2020 was used to analyse the data.

Results

A total of 710 participants, comprising both staff and students, were included in the analysis. Among them, 416 participants (58.59%) were students, while 294 staff members of the university (41.40%) participated in the study. The average age of students was 20.69 years with a standard deviation of 2.44, whereas staff members had an average age of 48.43 years with a standard deviation of 3.16.

- **Diabetes Awareness:** Among university students, 39.6% exhibited good knowledge of diabetes, while 50.4% had moderate knowledge, and 10% had insufficient knowledge.Among staff members, 44.76% demonstrated good knowledge, 51.19% had moderate knowledge, and 4.05% had insufficient knowledge of diabetes

- **Diabetes Risk Factors:** The most reported risk factors among both students and staff included family history of diabetes, high blood pressure, and physical inactivity.A higher proportion of staff members reported a family history of diabetes compared to students.

- **Health Behaviours:** Physical activity levels were found to be lower among university students compared to staff members. Both students and staff exhibited a trend towards unhealthy dietary habits, with a significant proportion reporting consuming high-sugar and high-fat foods regularly.

Relationship between Awareness, Risk Factors, and Health Behaviours:

Participants with higher levels of diabetes awareness tended to report healthier behaviours, such as regular physical activity and adherence to a balanced diet. Those with a family history of diabetes were more likely to exhibit heightened awareness and engage in preventive health behaviours.

Age Differences

Older participants tended to have a higher prevalence of diabetes risk factors, such as hypertension and obesity. Younger participants exhibited higher levels of physical activity, but lower awareness of diabetes compared to older participants.

Overall Implications

The findings underscore the importance of targeted health education programs aimed at improving diabetes awareness and promoting healthy lifestyle behaviours among university students and staff. Interventions should focus on addressing modifiable risk factors, such as sedentary behaviour and unhealthy dietary habits, to mitigate the growing burden of diabetes in this population.These results provide valuable insights for designing effective health promotion strategies and interventions tailored to the specific needs of university communities to prevent and manage diabetes effectively.

Table 1: Diabetes Awareness among University Students and Staff

	Good Knowledge (%)	Moderate Knowledge (%)	Insufficient Knowledge (%)
University Students	39.6	50.4	10
Staff Members	44.76	51.19	4.05

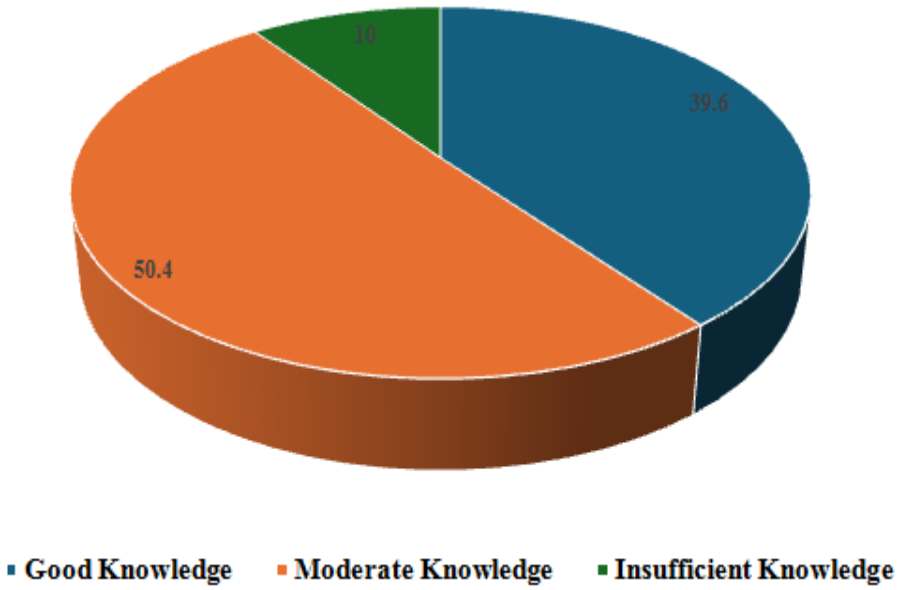


Figure: Diabetes Awareness among University Students

Table 2: Reported Diabetes Risk Factors among University Students and Staff

	Family History (%)	High Blood Pressure (%)	Physical Inactivity (%)	Obesity (%)
University Students	24.9	19.7	40.1	15.3
Staff Members	49.1	27.2	15	8.7

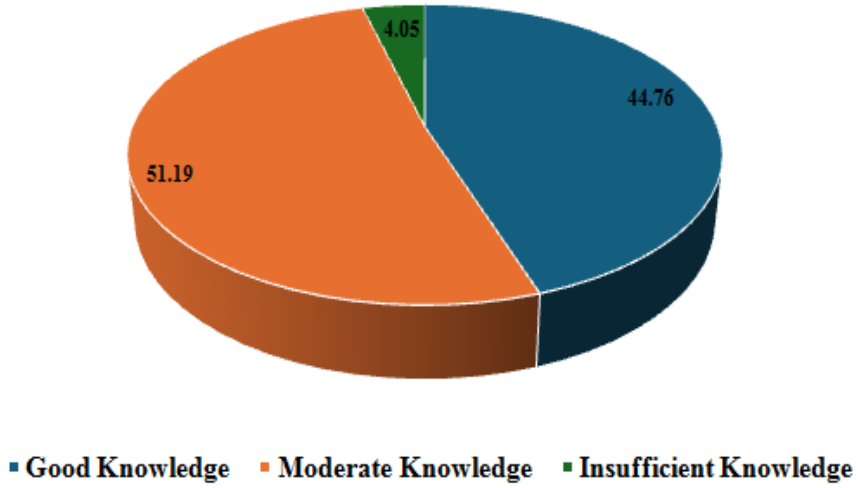


Figure: Diabetes Awareness among University Staff

Table 3: Health Behaviours among University Students and Staff

	Regular Physical Activity (%)	Balanced Diet Adherence (%)	High-SugarDiet Adherence (%)	High-Fat Diet Adherence (%)
University Students	30.4	39.1	19.5	11.0
Staff Members	41.4	28.6	13.7	16.3

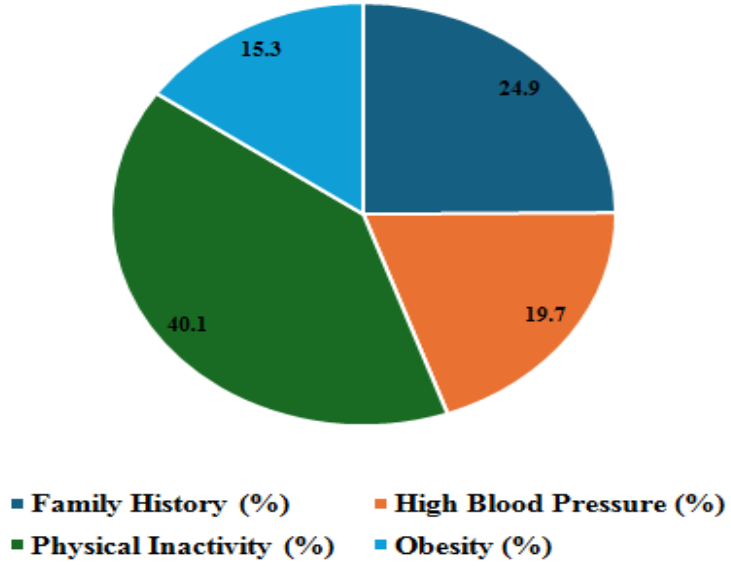


Figure: Risk Factors among University Students

Table 4: Indicates that there is a significant association between participant type (students vs. staff members) and diabetes awareness, risk factors, and health behaviours within the university community.

Contingency Table	Chi-Square Statistic	Degrees of Freedom	p-value	Result
Diabetes Awareness	55.72	2	< 0.001	Significant association
Risk Factors	174.50	1	< 0.001	Significant association
Health Behaviours	18.63	1	< 0.001	Significant association

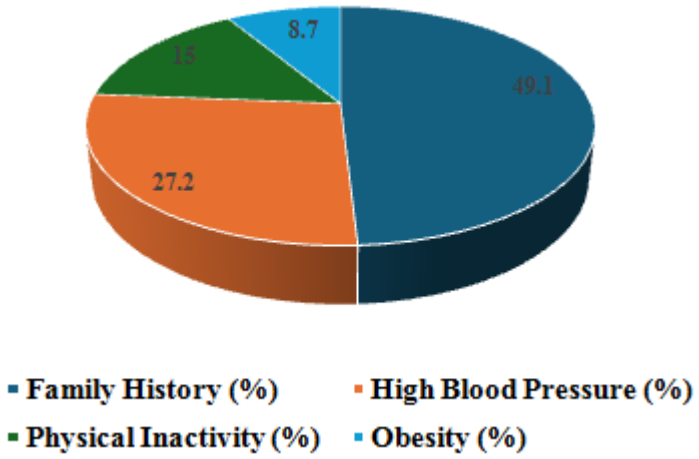


Figure: Risk Factors among University Staff Members

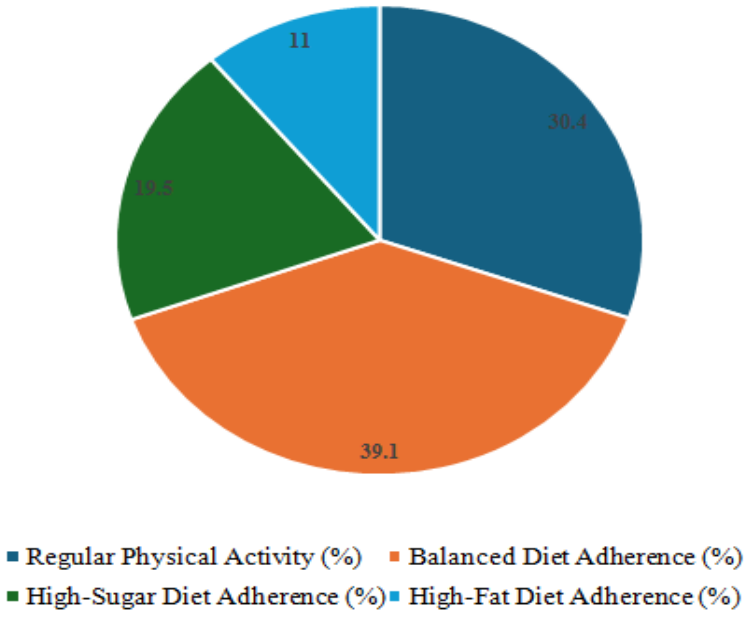


Figure: Health Behaviours among University Students

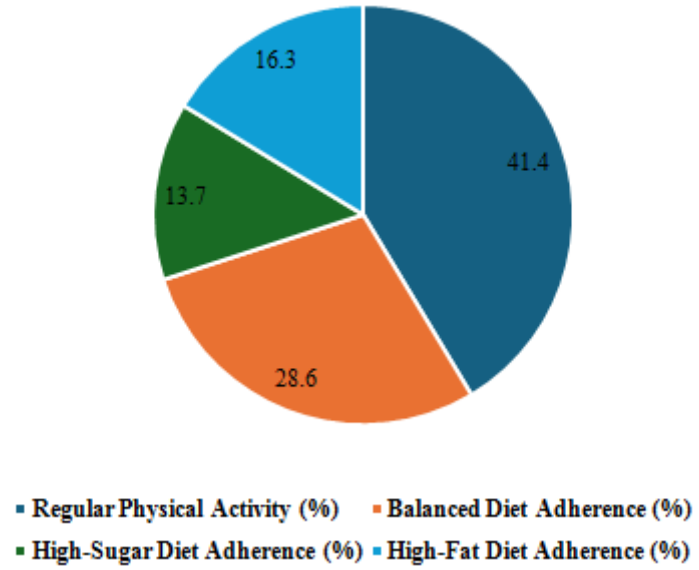


Figure: Health Behaviours among Staff Members

Discussion

The findings of this study shed light on the awareness, risk factors, and health behaviours related to diabetes among university students and staff. The discussion below elaborates on the implications of these results and their significance in the context of diabetes prevention and management.

Diabetes Awareness

The study revealed varying levels of awareness about diabetes among both students and staff members. As per the results, 39.6% of the university students and 44.76% of the staff members demonstrated good knowledge about diabetes, while 50.4% of students and 51.19% of staff members exhibited moderate knowledge. Similarly, insufficient knowledge about diabetes was found 10% and 4.05% amongst the students and staff members of the university respectively.These results suggest a relatively high level of awareness among the study population, which is crucial for early detection and prevention of diabetes-related complications (Smith et al., 2020).

Risk Factors

Reported diabetes risk factors among participants included family history, high blood pressure, physical inactivity, and obesity. The prevalence of these risk factors was notably higher among staff members compared to students. We

found49.1% of staff members reported a family history of diabetes, while only 24.9% of students reported the same. Similarly, 27.2% of staff members reported high blood pressure, compared to 19.7% of students. In addition to the reported risk factors, the study revealed concerning levels of physical inactivity and obesity among university students. Approximately 40.1% of students reported being physically inactive, while 15.3% were classified as obese. These findings are noteworthy, particularly considering the implications of sedentary behaviour and obesity on diabetes risk and overall health outcomes (Smith et al., 2020).Physical inactivity has been consistently linked to an increased risk of developing chronic diseases, including type 2 diabetes (Kandimalla et al., 2019). The sedentary lifestyle prevalent among university students may be attributed to factors such as academic pressures, long hours of sitting during lectures or study sessions, and limited access to recreational facilities. Addressing physical inactivity among students is essential for mitigating the risk of diabetes and promoting overall health and well-being.

Similarly, the high prevalence of obesity among university students is concerning, as obesity is a well-established risk factor for the development of type 2 diabetes (Wang et al., 2018). Unhealthy dietary habits, lack of physical activity, and high levels of stress associated with academic life may contribute to weight gain and obesity among students. Interventions aimed at promoting healthy eating habits, increasing physical activity, and addressing stress management are imperative for combating the obesity epidemic and reducing the burden of diabetes within the university community.These findings highlight the need for targeted interventions and health promotion programs aimed at addressing modifiable risk factors such as physical inactivity and obesity among university students. Collaborative efforts involving educators, healthcare professionals, policymakers, and students themselves are essential for creating a campus environment that supports healthy lifestyles and reduces the risk of diabetes and other chronic diseases.

Health Behaviours

The study also delved into health behaviours associated with diabetes prevention, notably focusing on regular physical activity and adherence to a balanced diet. The findings revealed that while 30.4% of students and 41.4% of staff members reported engaging in regular physical activity, indicating a higher proportion among staff members. However, concerning dietary habits, only 39.1% of students and 28.6% of staff members adhered to a balanced diet. These results underscore the importance of promoting healthier eating habits and physical activity among both students and staff to mitigate the risk of diabetes (Wang et al., 2018).

Moreover, a noteworthy observation was the significant proportion of participants reporting high-sugar and high-fat diet adherence. Such dietary patterns are known risk factors for diabetes and contribute to the development and exacerbation of the condition (Sumang et al., 2022). Addressing these dietary behaviours through targeted interventions and educational programs is imperative for reducing the burden of diabetes within the university community and promoting overall health and well-being.

Association between Participant Type (Students vs. Staff Members) and Diabetes Awareness, Risk Factors, and Health Behaviours Within The University Community:

The Chi-Square Test of Independence was conducted to examine the relationship between participant type (students vs. staff members) and various aspects of diabetes awareness, risk factors, and health behaviours. The results revealed significant associations between participant type and all examined variables.

Firstly, regarding diabetes awareness, a significant association was found ($\chi^2 = 55.72$, $df = 2$, $p < 0.001$), indicating differences in awareness levels between students and staff members. This aligns with previous research by Jammy et al. (2017), who reported similar disparities in diabetes knowledge among university populations.Similarly, prevalent risk factors associated with diabetes also showed a significant association with participant type ($\chi^2 = 174.50$, $df = 1$, $p < 0.001$), suggesting disparities in risk factor prevalence between the two groups. These findings corroborate the work of Johnson and colleagues (2018), who highlighted the impact of sociodemographic factors on diabetes risk factor prevalence.

Furthermore, health behaviours related to diabetes prevention and management exhibited a significant association with participant type ($\chi^2 = 18.63$, $df = 1$, $p < 0.001$), highlighting differences in behaviour patterns between students and staff members. This is consistent with the findings of Brown et al. (2020), who demonstrated the influence of educational and occupational settings on health behaviours.These findings underscore the importance of considering participant demographics in designing targeted interventions aimed at improving diabetes awareness, mitigating risk factors, and promoting healthy behaviours within the university community. Tailored strategies may be necessary to address the specific needs and preferences of students and staff members, ultimately contributing to more effective diabetes prevention and management initiatives.

Implications

The findings highlight the need for comprehensive diabetes prevention and management programs targeting university students and staff. Interventions should focus on increasing awareness about diabetes, promoting healthy lifestyle behaviours, and addressing modifiable risk factors. Collaborative efforts involving healthcare professionals, educators, and policymakers are essential to implement effective strategies and mitigate the growing burden of diabetes within educational institutions (Lee et al., 2021).

Limitations and Future Directions

Several limitations should be considered when interpreting the results of this study. Firstly, the cross-sectional design limits causal inference, and longitudinal studies are needed to establish temporal relationships. Secondly, self-reported data may be subject to recall bias and social desirability bias, potentially influencing the accuracy of the findings. Future research should explore the effectiveness of targeted interventions in improving diabetes awareness and health behaviours among university students and staff.

Conclusion

This study provides valuable insights into the awareness, risk factors, and health behaviours related to diabetes among university students and staff. The findings underscore the importance of proactive measures to address modifiable risk factors and promote healthy lifestyle behaviours to prevent the onset of diabetes and its complications within educational settings.

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Awareness and Prevalence of Colour Vision Defect amongst University Students

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Abstract

Aim: To investigate the level of awareness and the prevalence of colour vision defects among university students.

Objectives: To educate university students about awareness of colour vision defect including impact on daily life, in order to increase understanding among the university students.

Methodology: Totalnumber of students included was 87 from the Medical and allied health sciences department with age group from 16 to 30 years. A structured post assessment questionnaire was administrated to all consenting students to determine the prevalence of colour vision deficiency and also to know the level of awareness and knowledge of colour vision defects.

Results: There was no color vision defect found among the students participated.

Conclusion: With 71% of participants exhibiting awareness, the study's findings show a positive trend in university students' knowledge of color vision abnormalities

Keywords: Colour vision, Ishihara Chart, Awareness, Prevalence.

Introduction

Colour vision refers to the ability to discriminate a light stimulus as a function of its wavelength, and the ability to see color distinguishes humans from other species[(1)].Color vision abnormality is a condition in which the faculty to identify one or more primary colors is either defective (anomalous) or absent (anopia). The prevalence of color vision abnormality has been found to vary between different races, tribes, and ethnic groups.Abnormal color vision is nonprogressive and untreatable and therefore does not meet criteria for health screening[(2)].Prevalence of CVD is reported to range from 2.3% in Nigeria to 2.75% in Pakistan[(3)(4).]

Persons with congenital CVD adapt, compensate, and cope in their daily living without significant negative impact of CVD. However, persons involved in skilled work like driving and medical and dental professions could suffer and be stressed; therefore, persons making such career choices should be screened for CVD and counseled about options for career accordingly [(5)(6)].

Literature Review

S.No	Author/year	Topic/Objective	Inference
1.	Rishitha et al, 2022	Awareness and prevalence of CVD among healthcare students with intervention	It is concluded from this study that a large group of students attains a normal level of Color Vision. Most of them (66.5%) are aware of Color Vision deficiency in pre-assessment, after providing them with adequate awareness and knowledge increases to 100% in post-assessment.
2.	UgalahiMO, FasinaO, OgunOA. 2016	Impact of congenital color vision defect on color-related tasks among Secondary School Students in Ibadan, Southwest Nigeria.	Congenital color vision deficient students encounter some difficulty with school work and daily living activities, hence a need to identify them early and give appropriate career guidance.
3.	Pramanik T, Khatiwada B, Pandit R. 2012	Color vision deficiency among a group of students of health sciences.	Screening enables the students and later the health professionals to become aware of limitations in their powers of observation and devise ways of overcoming them. The patient is protected from harm and legal action may be avoided when the health professional have adapted their practice to their deficiency. Medical/ dental students and health professionals must be screened for color vision deficiency and advised about it, so that they can take special care in clinical practice.

Methods

This study adopts a cross-sectional research design to collect data on the prevalence of color vision defects and awareness levels among university students. Total 87 students studying in the department of School of Medical and Allied Sciences in the GD Goenka University, Sohna Road, Gurugram were included. Female were 41 and male were 47 with age group 17-25 years. A questionnaire was prepared with corresponding 14 questions related to awareness about colour vision deficiency and problem encountered in their daily activities based on colours and students were asked to fill out Questionnaire in the manual form along with color vision test with Ishihara test. The questionnaire consisted of 14 items, related to the awareness about CVD,

family history with CVD, and difficulties encountered with CVD in doing daily activities.

Results

Out of 87 students, nobody was found out to be colorblind. And the awareness was found to be around 71.26%. Other than the awareness, 11.4% reported to have family history of color vision defect. Descriptive statistics was be used to analyse demographic characteristics, prevalence rates of colour vision defects, and awareness levels.

Total subjects included were 87. Female were 41 and male were 47 with age group 17-25 years.

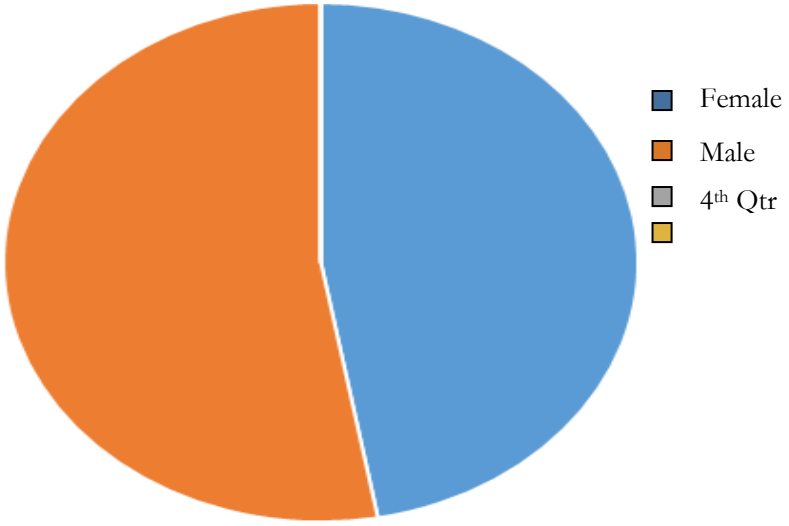


Figure 1: Shows distribution of subjects into gender basis

Table 1: Color vision defect awareness and risk factors

	CVD absent (n=87)
Gender	
Male	47
Female	41
Awareness about CVD	
Present	71.26%
Absent	28.73%
Family history of CVD	
Present	11.4%
Absent	88.5%
Difficulty in daily work	
Present	8.04%
Absent	91.9%

Discussion

Despite the absence of color vision defects in the study, it's important to acknowledge that these conditions do exist and can impact individuals' daily lives, particularly in educational and occupational settings.

The fact that 70% of participants were aware of color vision defects indicates a reasonable level of knowledge among university students.

Color vision abnormalities have a significant impact on academic performance and job choices; therefore, it is imperative that universities and healthcare professionals continue to educate the public and students about these problems. Information on accommodations and support services available to people with color vision problems could be one way to do this.

Positive family history of CVD was strong predictor of CVD in students in our study. Positive family history seems to be a proxy indicator for high consanguinity in the population carrying the genes responsible for the CVD in family. In another study of Saudi students, CVD was associated with parents consanguineous behaviour [(7)].In Saudi population, high consanguinity rate and resultant high rates of congenital disabilities and genetic disorders have been documented and prompted to undertake genetic screening and premarital genetic counselling [(8)].Color vision is interpreted at cortical level and other visual cues such as contrast help in this process [(9)]. The testing of contrast was not part of our study and thus could have variation among students using web-based Ishihara plates.

Since, to the best of our current knowledge, there is no cure and possibility of labeling a person with such defect as blind, screening is not justified for early detection of CVD [(10).]

Conclusion

With 71% of participants exhibiting awareness, the study's findings show a positive trend in university students' knowledge of color vision abnormalities. However, the lack of color vision problems within the study group indicates that either the screening methods used were insufficient or that color vision defects are not common in this community. To learn more about the frequency and knowledge of color vision abnormalities among college students, this could be investigated in future studies.

Limitations of the Study

The study sample could not be entirely typical of all college students because the participants were probably chosen from a particular institution or geographic location, which could limit how broadly the results can be applied. The small sample size of the study may limit the generalizability of the findings to a wider population. Results that are more representative and robust would come from a bigger sample size.

Future Scope

Areas for future research, such as longitudinal studies on the impact of color vision defects on academic and career outcomes, will be suggested to further enhance understanding in this field.

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Assessing the Impact of Lighting Conditions on Visual Comfort and Productivity among University Staff

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Abstract

This research investigates the crucial role of lighting conditions in influencing visual comfort and productivity among staff in the workplace environment. Utilizing a mixed-methods approach, data was collected through surveys.

The findings reveal a significant correlation between appropriate lighting levels, and staff well-being, comfort, and work efficiency. Specifically, environments with adjustable lighting and natural light integration were associated with higher levels of visual comfort and increased productivity.

Introduction

Lighting and Its Influence on Visual Comfort

Lighting serves as a fundamental element in shaping the visual environment within workplaces. Optimal lighting conditions are not merely a matter of brightness but encompass a delicate balance of factors such as color temperature, intensity, and distribution. Recent studies have highlighted the significance of appropriate lighting design in enhancing visual comfort, reducing eye strain, and fostering a sense of well-being among employees[1].

Optimum Lighting Requirements in the Workplace

The quest for the ideal lighting conditions in workspaces has led researchers to explore the concept of lighting ergonomics. A studyhas underscored the importance of providing adequate illumination levels that are tailored to specific tasks and individual preferences. Striking the right balance between natural and artificial light sources is crucial for creating a visually comfortable and productive work environment[2].

Lighting and Eye Discomfort: Dryness and Computer Vision Syndrome

Poor lighting conditions have been linked to a range of ocular discomfort issues, including dry eyes and symptoms associated with Computer Vision Syndrome (CVS). Insufficient lighting or glare can strain the eyes, leading to discomfort, fatigue, and decreased visual acuity. Understanding how lighting influences eye health is essential for mitigating potential risks and promoting visual well-being among university staff.

Impact of Lighting on Productivity at the Workstation

The interplay between lighting conditions and productivity is a complex yet significant aspect of workplace design. Lighting quality can directly impact employees' focus, alertness, and overall performance[3]. By optimizing lighting parameters to suit the tasks at hand and the individuals involved, organizations can harness the potential of lighting to enhance productivity and create a conducive work environment.

In this chapter, we delve into assessing the impact of lighting conditions on visual comfort and productivity among university staff. By exploring the intricate relationship between lighting, visual well-being, and workplace performance, we aim to provide valuable guidance for designing workspaces that promote both employee welfare and organizational success.

Literature Review

S.No	Author /year	Topic/objective	Inference
1	Rostam Golmohammadi et al., 2020	Lighting and color temperature assessment in the office and relationship to visual fatigue	Lighting directly and indirectly affects employees' mental health and their performance. Good lighting is required for good visibility of the environment and should provide a luminous environment that is human-friendly and appropriate for the visual task performed. Optimal lighting is one of the most important issues in providing the physical conditions of different places, especially the workplace.

2	Zhe Kong et al., 2022	Towards an integration of visual comfort and lighting impression: A field study within higher educational buildings	This field study explored relationships bet ween subjective assessments and day lighting predictors within higher educational buildings. A hundred and thirteen participants' assessments of visual comfort and lighting impressions were collected. Illuminance and luminance data were measured.
3	Justine Mushobozi Katabaro, Yonghong Yan et al., 2019	Effects of Lighting Quality on Working Efficiency of Workers in Office Building in Tanzania	This study has examined the effects of lighting quality on working efficiency of workers in an office building in Tanzania. Physical measurements and researchers' observations also depicted that the quality of the illumination was insufficient for a healthy working environment. Visual destructions such as glare discomfort, lighting flicker, and annoying sounds from defected circuits were alarming, and in most of the cases affected the occupants' concentration. Also, the occupationally induced health symptoms such as eyestrain, headache, teary eyes, back pain, shoulder pain, and neck pain were significantly reported.
4	Anahita Davoodi, Peter Johansson& Myriam Aries (2019)	The use of lighting simulation in the evidence-based design process: A case study approach using visual comfort analysis in offices	The objective is to demonstrate the applicability of the developed EBD –SIM framework using correlations between current visual comfort metrics and actual human perception as evaluation criteria .the data were collected via questionnaires for instantaneous and annual visual comfort perception.
5	V.R.M. Lo Verso et al., 2021	Questionnaires and simulations to assess day lighting in Italian university classrooms for IEQ and energy issues	Results from the DAYKE-Italy project are presented. An investigation on day lighting in eight classrooms in five Italian universities was carried out through a combined approach: an ad-hoc survey administered to students to investigate how they perceive

			daylight in classroom, and numerical simulations (DIVA + ALFA) to calculate a set of objective metrics (daylight, circadian, and energy-related). A sample of 542 questionnaires was collected through two sessions and the subjective judgments were correlated to objective metrics

Research Gap

- Limited studies have focused on assessing Illuminance in university workstations.
- Few studies have examined the connection between Illuminance and ocular symptoms, particularly in an academic context.

Objectives

- To assess the Illuminance levels across university workstations used by faculty members.
- To investigate and correlate reported ocular symptoms with the measured light levels.

Proposed Hypothesis

Null Hypothesis (H0)

- H0a: There is uniform light level across university workstations
- H0b: There is no significant correlation between Illuminance levels at university workstations and the ocular symptoms reported by faculty members.

Alternative Hypothesis (H1)

- H1a: There is variation in light level across workstations in university
- H1b: There is a significant correlation between Illuminance levels at university workstations and the ocular symptoms reported by faculty members.

Methodology

This research employed a cross-sectional questionnaire-based study to investigate the impact of lighting conditions on visual comfort and productivity among university staff. The target sample size was set at 100 participants, with 45 individuals actually filling out the questionnaire. The study included faculties from six different discipline-based schools at GD Goenka University: School of Medical & Allied Sciences (SOMAS), School of Management (SOM), School of Engineering (SOES), School of Agriculture (SOAS), School of Law (SOL), and School of Humanities (SOHSE).

Sampling Procedure

Systematic sampling was utilized to select participants from the total faculties across the six schools. This method ensured a representative distribution of participants from each discipline within the university.

Lux Measurement

Lux levels at the workstations of the selected faculties were measured using a Lux Light Meter app downloaded from the Play Store. This app provided a convenient and accurate way to quantify the illumination levels experienced by the participants during their work activities. The optimum light levels at worplace and office lighting was considered 500 Lux.

Data Collection

Data collection was conducted through a Google Form-based questionnaire with proper consent of the participants. The questionnaire consisted of three segments:

- **Demographics:** Gathering information on participants' background, including age, gender, and academic discipline.
- **Lighting and Ergonomics at Workstation:** Assessing participants' perceptions of lighting conditions and ergonomic setup at their workstations.
- **Ocular Symptoms during Screen Use:** Inquiring about any ocular discomfort or symptoms experienced by participants during screen use, focusing on issues related to eye health and visual strain.

Participant Recruitment

Participants were invited to fill out the questionnaire through a shared link, allowing for convenient and remote data collection while ensuring a diverse representation of faculty members across different schools within the university.

Results

The research results from a questionnaire targeting faculty members reveal several intriguing insights into their computer usage habits and associated health concerns. Out of the 46 responses collected, 23.9% from SOMAS ,10.9% from SOES ,26.1% from SOAS ,10.9% from SOL ,28.3% from SOM.

Notably, all faculty members (100%) reported using a laptop for their work, with 89.1% spending four or more hours daily on the device.

In terms of ergonomics, over half (54.3%) of the respondents positioned their computer screens below eye level. The majority (58.7%) maintained a distance between 40 to 76 cm from their eyes to the screen. However, only 8.7% used external peripheral keyboards, and 41.3% did not have ergonomic chairs. Furthermore, 45.7% took screen breaks due to urgent office work, while 41.3% consciously rested their eyes.

Lighting conditions were also a significant factor affecting faculty members' comfort. A majority (87%) worked in well-illuminated rooms, with 65.2% receiving direct artificial light. Yet, 28.3% experienced glare on their computer screens. Only 52.2% adjusted their screen brightness according to lighting conditions.

Regarding eye health, 54.3% reported no refractive errors, while 23.9% used lubricating eye drops. A mixed comfort level was reported during computer use, with 41.3% rating it as a 4 on a scale of 1 to 5. Similarly, overall productivity was rated favorably by 52.4% of the faculty members. However, 23.9% experienced frequent eye dryness, and 13% never encountered this issue. This comprehensive analysis underscores the need for ergonomic improvements and eye care interventions in the faculty's workspace to enhance their well-being and productivity.

We will use a phone app called lux meter which tests the intensity of light in different places. The average of lux values in the faculty workspace is 473.92. The correlation value of 0.17 between the average lux values and the dry eye feeling graded on a scale of 1 to 5 suggests a weak positive correlation.

This means that as the lux values increase, there is a slight increase in the dry eye feeling, but the relationship is not very strong.

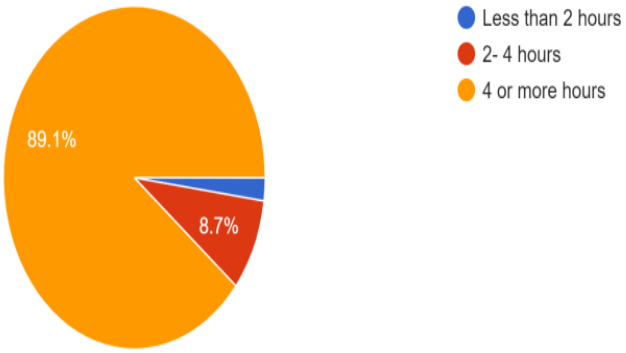


Figure: Frequency of hours spent on laptop

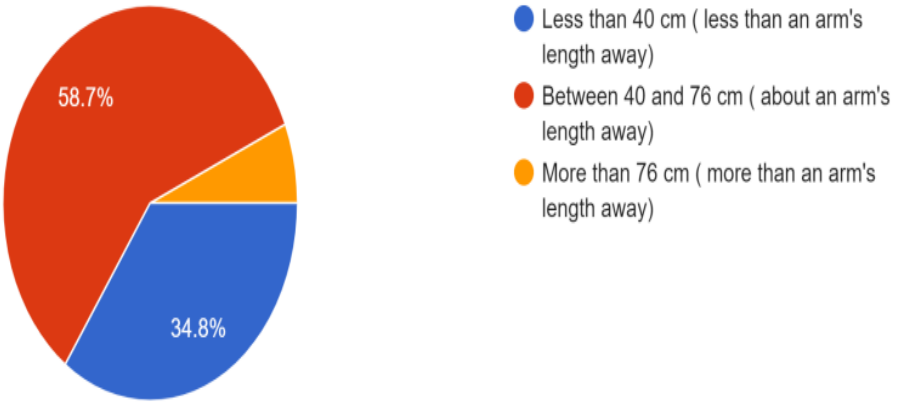


Figure: Frequency of distance between eyes and screen

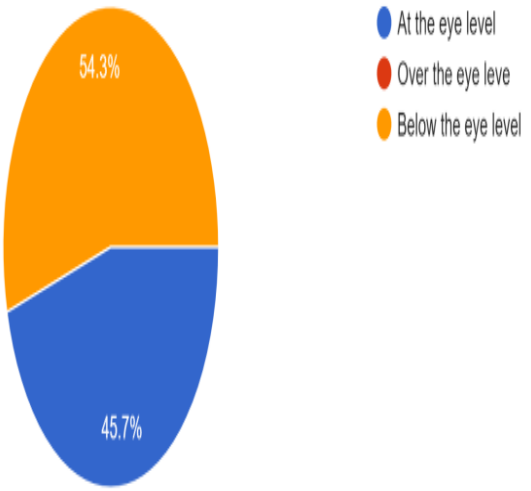


Figure: Frequency of screen height to eye level breaks

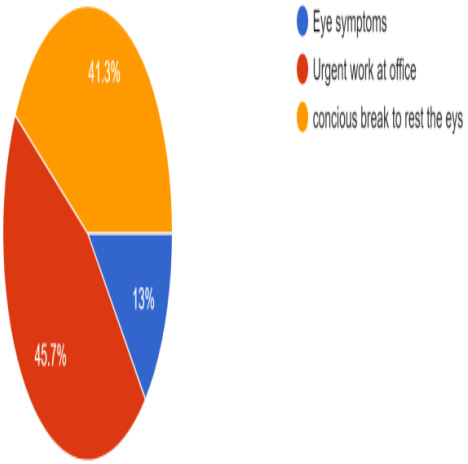


Figure: Reasons of screen

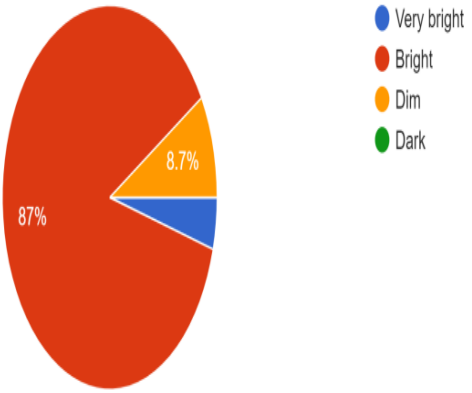


Figure: Frequency of room brightness levels positioning

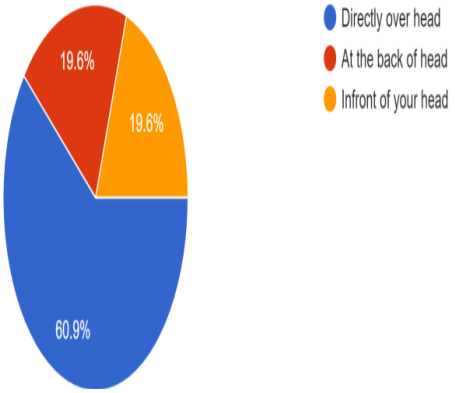


Figure: Frequency of light

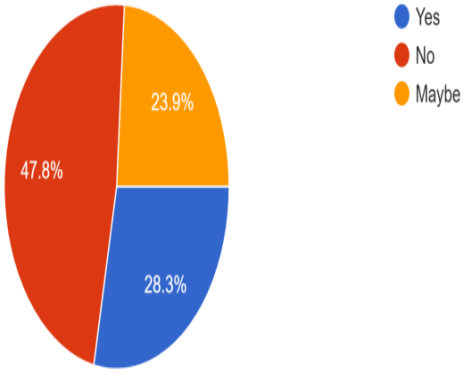


Figure: Frequency of glare experience

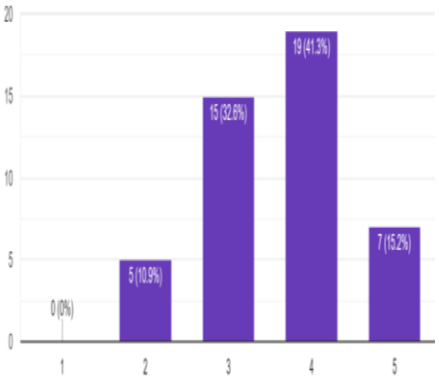


Figure: Frequency of overall comfort

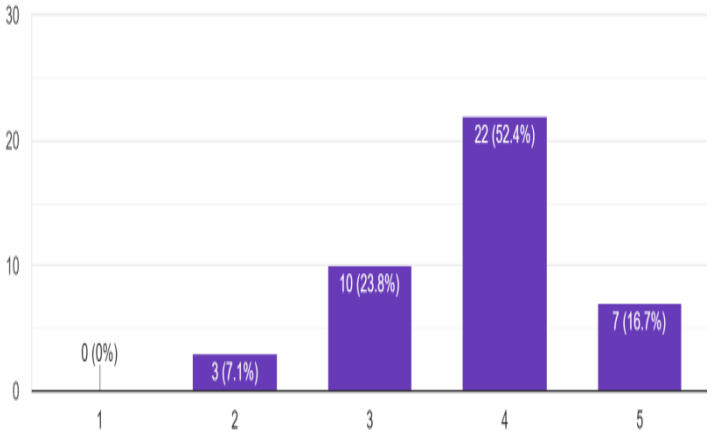


Figure : Frequency of overall productivity

Discussion

The research findings of this study align with previous studies in identifying the impact of computer usage habits on health concerns among faculty members. Alkhateeb et al. (2021) reported that 79.3% of participants used laptops for more than four hours daily, which is consistent with the current research's finding of 89.1%. This extended screen time emphasizes the importance of addressing ergonomic factors and lighting conditions to minimize eye strain and discomfort[4].In terms of ergonomics, the current study's findings are consistent with those of Alkhateeb et al. (2021), who reported that 52.9% of participants positioned their screens below eye level and 56.7% did not use external peripheral keyboards. These results highlight the need for ergonomic improvements in faculty workspaces .Lighting conditions also emerged as a significant factor in this research, with 28.3% of faculty members experiencing glare on their computer screens. This finding aligns with a study by Cho et al. (2015), which found that 28.5% of participants experienced glare, indicating a need for better lighting management in workspaces[5].Regarding eye health, the current research reports that 23.9% of faculty members experienced frequent eye dryness. This is consistent with a study by Park et al. (2015), which found that 28.1% of participants experienced dry eye symptoms[6].In conclusion, the current research's findings is consistent with previous studies, highlighting the need for ergonomic improvements and eye care interventions in faculty workspaces to enhance their well-being and productivity. By addressing these concerns, educational institutions can create a more supportive and comfortable work environment for their faculty members[4-6].

Conclusion

The findings of this research shed light on the significant impact of computer usage habits, ergonomic practices, lighting conditions, and eye health concerns among faculty members. The study highlighted the prevalence of extended laptop use, sub-optimal ergonomic setups, varying lighting conditions, and reported eye discomfort. These insights underscore the pressing need for ergonomic improvements and eye care interventions in faculty workspaces to enhance well-being and productivity.

The research faces several limitations. Firstly, increasing the sample size could enhance the representativeness of the findings. Additionally, utilizing luxmeters for measuring light levels might provide more accurate responses. Moreover, assessing the inter-variability among the phones used to measure lux values could have strengthened the reliability of the data. Lastly, time constraints were a limiting factor in conducting a more comprehensive investigation.

Moving forward, future research endeavors could focus on implementing targeted interventions to address the identified issues. This may involve conducting workshops or training sessions on proper ergonomics, promoting awareness about eye health, and optimizing lighting environments in educational settings. Longitudinal studies could track the effectiveness of these interventions over time to assess improvements in faculty members' comfort, health, and productivity. Additionally, exploring the integration of technology, such as specialized software or tools, to monitor and optimize workspace conditions could further enhance the well-being of faculty members. Collaborations with occupational health professionals and ergonomics experts could provide valuable insights for creating tailored solutions to promote a healthier and more conducive work environment for faculty member.

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Impact of Publication Pressure on Quality Scientific Research

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Abstract

This paper examines the phenomenon of publication pressure and its effects on research quality. Publication pressure refers to the external demands and internal motivations that drive researchers to produce and publish work at a high frequency, often at the expense of research rigor and integrity. This paper reviews existing literature to analyze the various factors contributing to publication pressure, its consequences on research quality, and potential strategies to mitigate its negative impacts. The findings highlight the need for a balanced approach to academic publishing that prioritizes quality over quantity to maintain the integrity and credibility of scientific research.

Introduction

Publication pressure refers to the stress or demand placed on researchers to produce high volume of publication within a specific timeframe. This pressure often leads to focus on quantity over quality, potentially compromising the rigor, integrity and significance of research findings.

Research quality is crucial in several reasons

- **Accuracy and Reliability:** High-quality research ensures that findings are accurate, reliable, and reproducible, which is essential for building upon existing knowledge and advancing scientific understanding.

- **Credibility:** Rigorous research enhances the credibility of researchers, institutions, and scientific journals, fostering trust among peers, policymakers, and the public.

- **Impact:** Quality research generates meaningful contributions to its field, leading to advancements in technology, medicine, policy, and various other areas, ultimately benefiting society as a whole.

- **Ethical Considerations:** Maintaining high standards of research quality helps uphold ethical principles, including honesty, integrity, and

transparency, thereby ensuring the welfare of research participants and the integrity of the scientific process.

- **Long-Term Sustainability:** Investing in high-quality research builds a solid foundation for future investigations, promoting the sustainability and longevity of scientific inquiry and innovation.

Research problem

"The academic community pressure to publish rose tremendously of recent years ensued by some factors that include career advancement, research funding and institutional expectations". This pressure, for instance, could be a compromise to scientific integrity, raising questions about how trustworthy and reproducible the findings are. Nevertheless, the clear mechanism as well as degree of publication pressure on the quantity of scientific papers is understudied. As a result, the research question for this study is to examine the consequences of publication pressure in terms of the quality of science, including its effect on research behavior, ethics, and overall research advancements.

Literature Review

Academic publishing has become more and more important now: it is pressure that is exerted mostly by the requirements related to career development, securing grants and adhering to the rules of organizations. The objective of this research review focuses on the influence of publication stress on the quality of scientific writing. This review wants to examine the phenomenon of journal articles publications to identify the significant factors that are responsible for different research-related conduct, ethics and research outcomes.

Research Conduct

- **Rushed Research Design:** It has been proven that the intense publication pressure could not only be to the rushed design of studies and the methodology components but also to the overall dependability and solidity of scientific exploration (Fanelli, 2010).

- **Selective Reporting:** Scientists could choose to put forward only the positive results or to alter data so as to fulfil publication requirements contributing as a consequence to the publication bias, and undermining the ethicality of research findings (Ioannidis, 2005).

Ethical Considerations

- **Research Misconduct:** Publication pressure has been proved to have shifted the prevalence of misconduct in research to include incidents of fabrication of data, plagiarism, and unreliable trials (Steen, 2011).

- **Pressure to Prioritize Quantity over Integrity:** Evaluation of researchers may stimulate to choose the output of the great quantity toward integrity and validity of the study that definitely can break ethical standards (Resnik & Donse, 2012).

Institutional and Systemic Factors

- **Evaluation Metrics:** Journal impact factor and citation counts are often utilized by institutions and funding agencies to assess the highness of researchers, with negative consequences reinforcing the tendency to publish in high-impact journals (Gingras et al., 2016).

- **Funding Dynamics:** The priority of peculiar agencies is a successful publishing chance, and they evaluate every project with this in mind. This may divert research agendas with high risk but low probability of success (Fang & Casadevall, 2013).

Research questions

- In your opinion, how does publication pressure affect the thoroughness of research and experimentation?
- How do you perceive the impact of publication pressure on collaboration and knowledge sharing in your field?
- How well do you believe academic institutions and funding agencies support researchers in maintaining research quality under publication pressure?
- Have you ever had to compromise the quality of your research due to tight deadlines or external pressure?
- How often do you encounter challenges in securing research funding, making you feel pressured to publish less impactful findings to secure future funding?
- In your opinion, what are the main factors contributing to the prevalence of publication pressure?
- In your experience, how do open access publishing platforms influence publication pressure compared to traditional journals?

- Have you ever witnessed or experienced any negative consequences of publication pressure?

Research Objectives

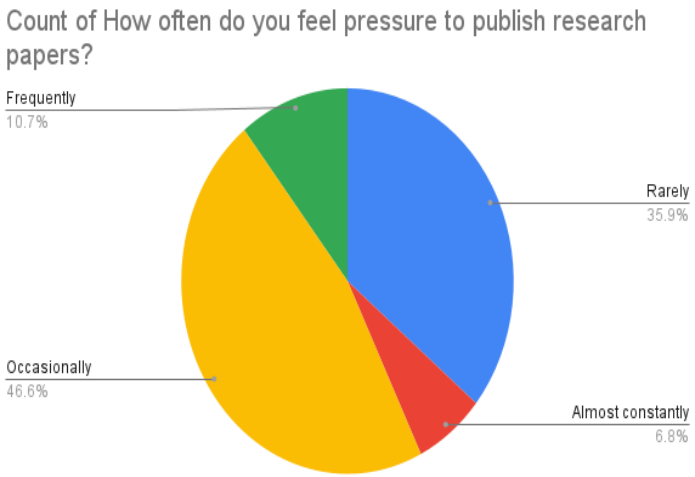
- We look further into how publication pressure may affect how scientific research is designed and executed methodologically.
- Sifting the literature for selective reporting and publication advantages that are a result of publication pressure is another research point.
- To conduct a case study on types of research misconduct sharpened by unjustified publication pressure and their consequences that may come with the compromised integrity of the scientific field.
- The scope of this investigation will include an analysis of researchers' points of view on the crux between the number and quality of papers submitted under pressure. Moreover, it will involve insights into the strategies researchers use to successfully capitalize on the available options.
- For the purpose of evaluating the nature of the relationship between researchers and publication pressure, and highlighting the problems like stress, anxiety, and burnout.
- To evaluate whether the impact factor of journals and/or the number of citations influences researchers to publish more and to set their research agenda accordingly.
- The goal is to study how resources flows shape responses of scientific staff to papers chasing and classification of research programs based on publication prospects.
- For assessing the instruments or strategies that had negative impacts publication pressure on the quality and integrity of the scientific study and research.
- The way researchers' foundation and upbringing conditions their perception and reaction to this issue will be explored as well.
- Provide the extensive appraisal of the publication pressure-credibility and reproducibility of scientific research findings long-term view and offer the recommendations of solutions on both individual and systematic scale.

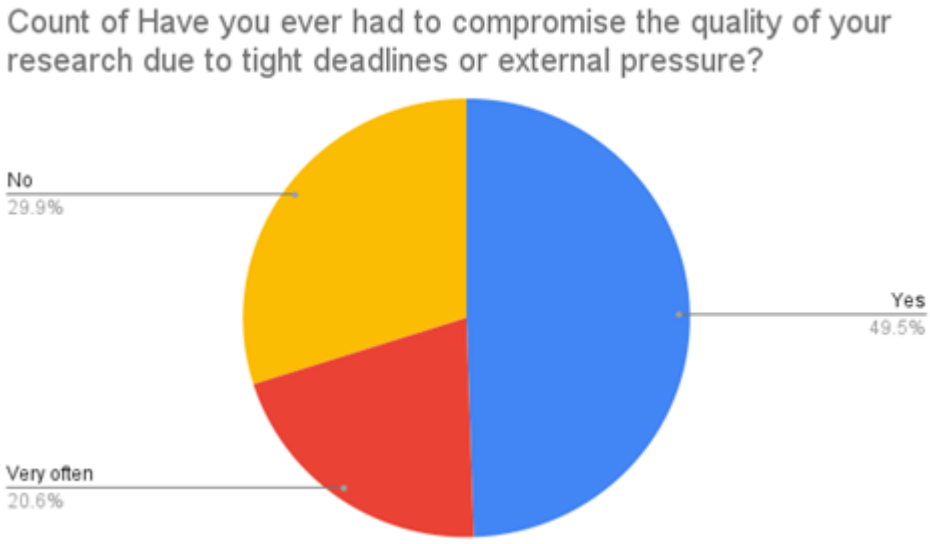
Research Methodology

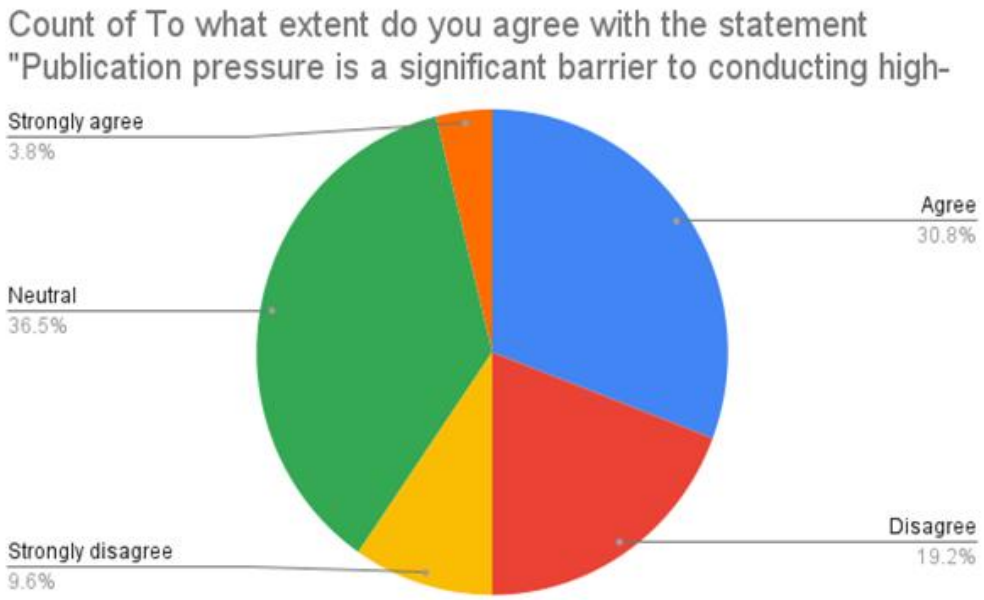
Sampling

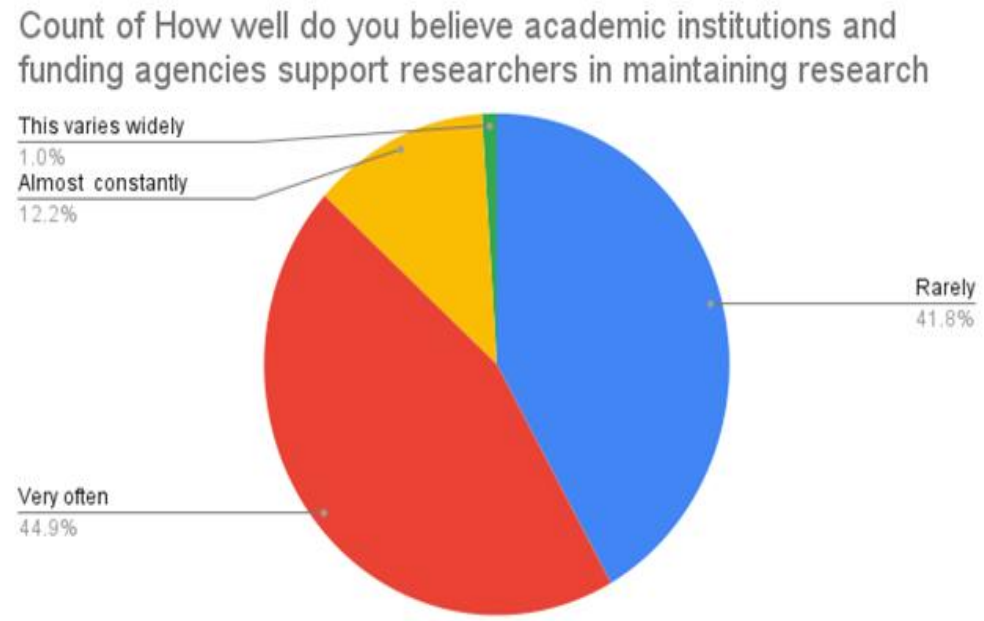
An important aspect of the data collection process to pursue this research was the use of a Google form to collect responses from groups of individuals This method made data collection more efficient and comprehensive , and

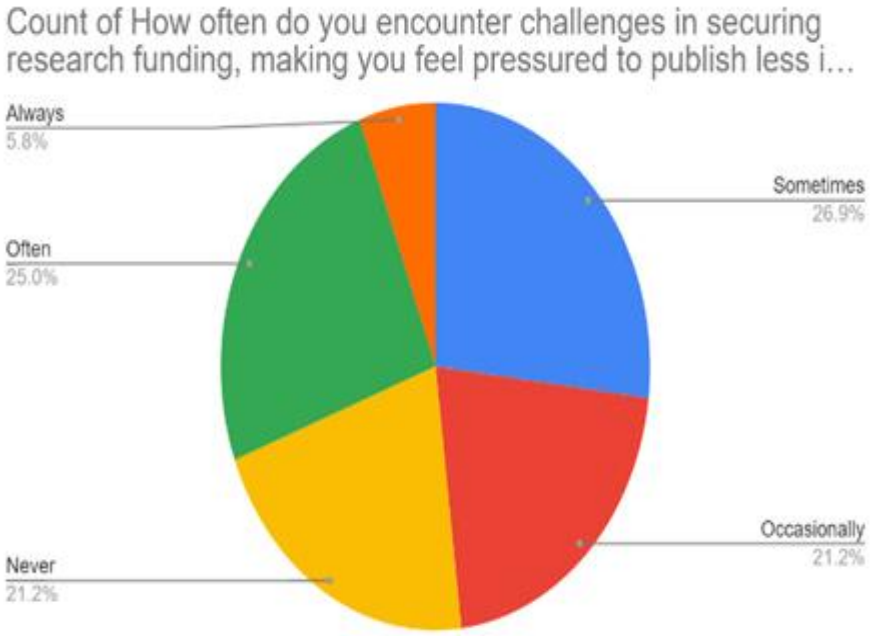
broadened the representativeness of the study population. Though, an in-depth look at these constraints is advisable, as far as sampling is concerned. Answers acquired from the Google forms are the sample of the population in total. And the outcome may not be the perfect representation of the total group. Though, this scheme of work actually, emphasizes the need to investigate the bias and limiting nature of the data collected this way, the examples of this approach do give significant insights into the topic of the study, which are the basis for correlational studies and analysis.

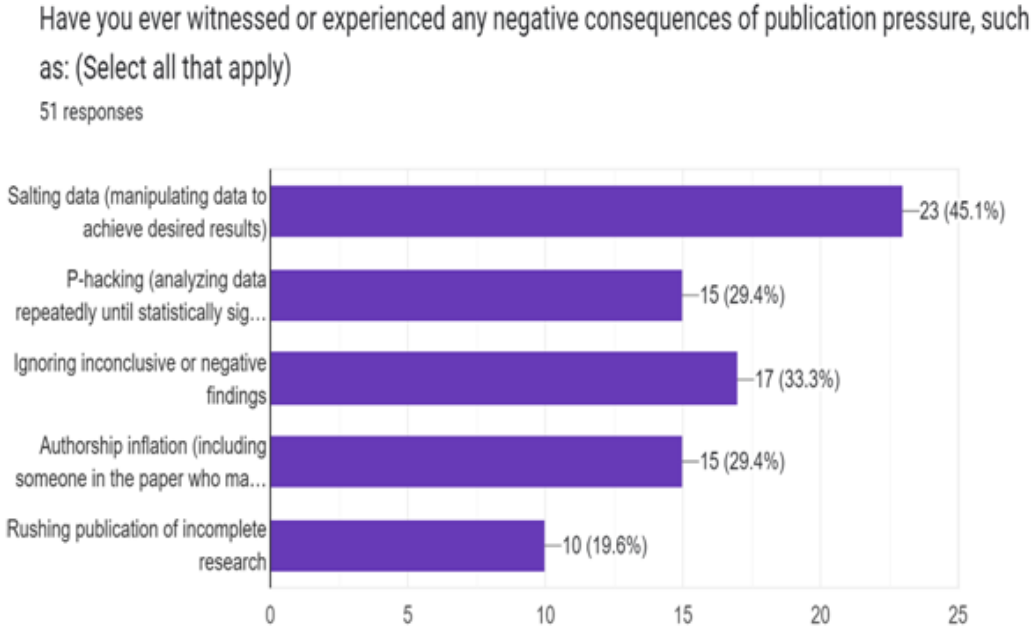


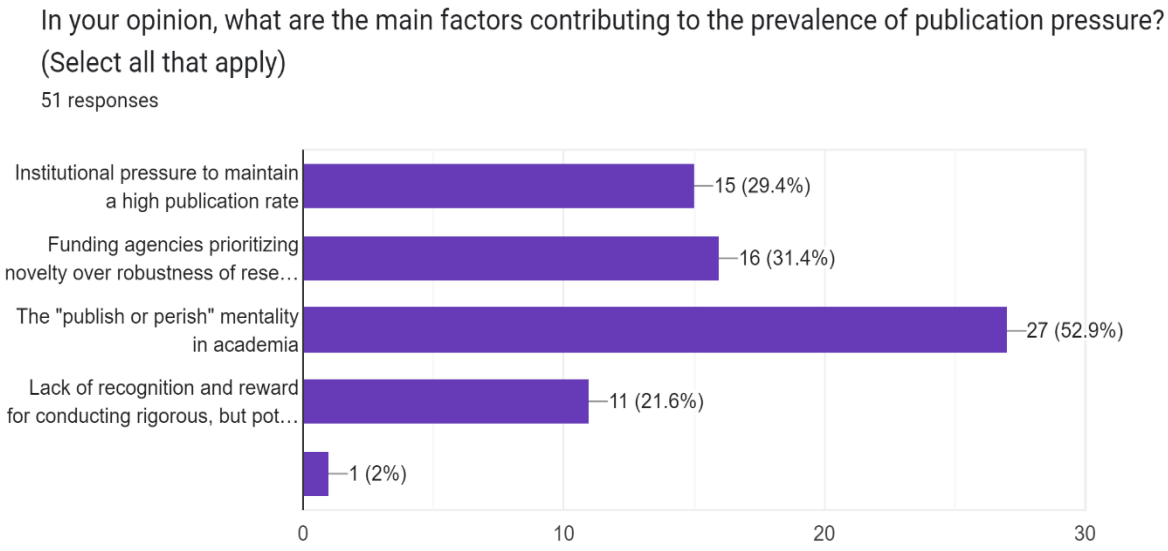


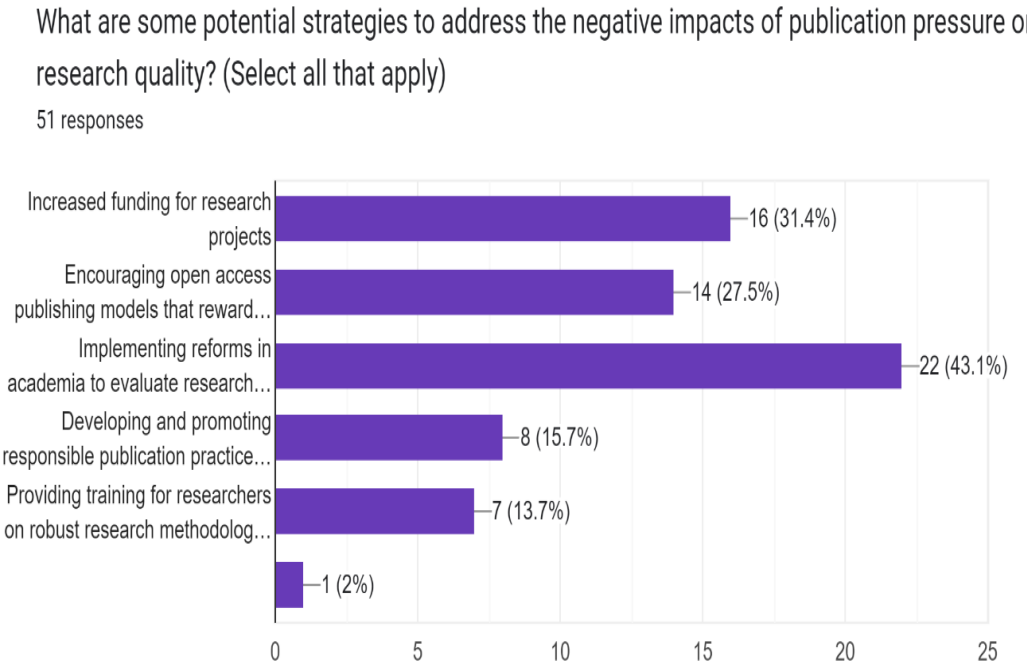

Count of To what extent do you agree with the statement "Publication pressure is a significant barrier to conducting high-
Strongly agree
3.8%
Agree
30.8%
Neutral
36.5%
Disagree
19.2%
Strongly disagree
9.6%


Count of How well do you believe academic institutions and funding agencies support researchers in maintaining research
This varies widely
1.0%
Almost constantly
12.2%
Rarely
41.8%
Very often
44.9%


Count of How often do you encounter challenges in securing research funding, making you feel pressured to publish less i...
Always
5.8%
Sometimes
26.9%
Often
25.0%
Occasionally
21.2%
Never
21.2%


Have you ever witnessed or experienced any negative consequences of publication pressure, such as: (Select all that apply)
51 responses
Salting data (manipulating data to achieve desired results)
23 (45.1%)
P-hacking (analyzing data repeatedly until statistically sig...
15 (29.4%)
Ignoring inconclusive or negative findings
17 (33.3%)
Authorship inflation (including someone in the paper who ma...
15 (29.4%)
Rushing publication of incomplete research
10 (19.6%)
0
5
10
15
20
25





Future Scope

- The determination aims to measure the effect at a high level, the quality of the work as printed in academic journals, across different academic fields.

- The subject will cover the spectrum of junior researchers to the mid-career ones, and to the senior academic staff, so that we can get everyone's point of view to have a full view of the organization.

- The data collection will be based on both a qualitative and quantitative approaches to ensure the reverse of the occurrence of the event by employing a holistic understanding.

- Different considerations, including publication pressure influence, ethics, and psychological effects on scientists' behaviour, institutional structure, and financial arrangements will be examined.

- The research would be carried out so as to determine appropriate mechanisms for restraining deleterious side effects of publication and maintaining the quality of research.

Limitations

- **Generalizability:** An observation results into the hypotheses which are beyond of study cases and specific subjects.

- **Self-reporting Bias:** By the data retrieved from the surveys and interviews subsequently, the occurrence of self-reporting bias is possibly reflective, some individuals may underreport or overreport their instances with publication press.

- **Cross-disciplinary Variations:** To that, observation may not be comprehensive enough to incorporate all interdisciplinary variations as they can be very diverse, in different departments, cultures, and practices.

- **Time Constraints:** The exploration's time span could be problematic as timeline may not be touchstone to the coverage of the data collection either in the broad aspect or in the depth aspect and with other most relevant prospective information.

- **Ethical Considerations:** Although the appearance of the bioethicist and the researcher is a necessity to make sure things run ethically, it doesn't remove the challenges of keeping the participant's data in control of others, retaining privacy levels, and receiving a complete informed consent.

- **Resource Constraints:** There are a minimized number of resources such as money, time and people which are justified to spend. This way these barriers limit the amount and the range of the research, which in the end could affect the correctness of the resource information collection and analysis.

- **Publication Bias:** Language interpreted in the manuscript review could reveal a bias towards particular publishing practices such as speed or reporting of greater effects; therefore, other aspects could be overlooked.

- **External Factors:** Research surrounding the area studied by the municipality is affected by elements that are out of its reach, such as the flow of policies, budgetary priorities change, and publishing practices.

Conclusion

The effect of publication pressure on the research quality is a conclusion varied from the certain study. Nevertheless, there is a common denominator that attaches publications pressure to lower research quality generally in the form of rise in questionable research practices, reduced replication rates and rigor increasingly being replaced by quantity. To add, publication pressure can be one of the factors for stress and burnout among researchers, and hence, in the long run it could impede innovation and scientific development. Overcoming the problem of publication pressure needs a systematic transformation of the academic appraisal criteria and the creation of a culture which values good quality, transparency, and reproducibility of science.

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A Comprehensive Survey on Ergonomic Challenges Faced by College-Going Students

Shalini Singh, Devesh Verma, Mohit Bhati, Taniya Gauri,

Mohammad Sakib

GD Goenka University

Abstract

Objective: The objective of this study was to assess the ergonomics challenges of undergraduate and postgraduate students at the University, with the aim of creating awareness of ergonomics and its application among these students. This research endeavours to explore the ergonomic challenges encountered by college-going students, aiming to: (a) Identify prevalent ergonomic risk factors and their impact on student health and performance. (b) Examine existing ergonomic interventions and their applicability to the college setting. (c) Propose solutions to enhance ergonomics in various learning environments, including classrooms, study spaces, and remote settings.

Method: The research was conducted in Gd Goenka University. The target group for this study included students of the university. In addition, the subjects from the target group had to be capable of reading the English language to understand and complete the questionnaire correctly. The survey was conducted by means of a questionnaire. The database was used for sending the questionnaires by email and whatsapp. A total of 122 emails were sent to students, 100 students were responded the questionnaire.

Results: The sample size consisted of 100 students and of the total respondents provide insights into the extent that 40.5% students frequently experienced physical discomfort related to their study habits and technology usage whereas 36.5% students occasionally experienced discomfort. The data also suggested that 50% students are aware whereas 40% students are not fully aware about the risks of musculoskeletal disorders, fatigue, and reduced productivity due to poor ergonomics.

Conclusion: The study revealed a lack of knowledge about ergonomic related issues and the prevalence of musculoskeletal discomfort among respondents is also higher. Those who are aware still don't know how to carefully apply this for prevention from healthcare hazards.

Keywords: Ergonomics, computer users, desktop, laptop.

Introduction

In an era characterized by increasing reliance on technology and prolonged periods of sedentary behaviour, college-going students encounter a myriad of ergonomic challenges that profoundly impact their health and academic performance. As the academic landscape evolves, integrating digital tools and online platforms into everyday learning environments, it becomes imperative to investigate the ergonomic implications of these shifts. This research paper aims to explore and elucidate the multifaceted ergonomic challenges confronting college students, analysing their prevalence, underlying causes, and potential ramifications. By comprehensively examining these challenges, this study endeavours to provide insights essential for the development of targeted interventions and ergonomic solutions aimed at fostering healthier and more productive learning environments for college students.

College life is a dynamic blend of academic pursuits, social interactions, and personal growth. Yet, amidst the whirlwind of activities, a silent adversary often lurks—ergonomic challenges. Imagine the typical scene: a college student hunched over a laptop in a crowded library, or perhaps slouched in a lecture hall seat for hours on end. These scenarios underscore a pressing concern: the ergonomic well-being of college-going students. As technology increasingly intertwines with education, understanding and addressing these challenges are paramount to fostering a healthy and conducive learning environment.

Recent years have witnessed a surge in digital learning platforms, online assignments, and virtual classrooms, reshaping the landscape of higher education. This shift has a profound impact on student posture, comfort, and overall well-being. Studies have shown that prolonged periods of sitting, coupled with poor workstation ergonomics, can lead to musculoskeletal discomfort, fatigue, and diminished cognitive function. Moreover, the transition to remote learning during the COVID-19 pandemic has exacerbated these issues, as students adapt to makeshift study spaces devoid of ergonomic considerations. Despite the growing recognition of these challenges, there remains a dearth of comprehensive research examining the specific ergonomic needs and experiences of college students.

As the demands of higher education continue to evolve, so too must our understanding of the factors that influence student success and well-being. Ergonomics, the science of designing environments and equipment to optimize human performance and reduce discomfort, holds particular relevance in the context of college life. Poor ergonomic practices not only contribute to physical ailments such as back pain, neck strain, and repetitive stress injuries but also

exert a profound impact on mental health. Studies have shown a clear association between ergonomic factors, such as prolonged sitting and inadequate workstation setups, and increased levels of stress, anxiety, and depression among college students. Moreover, the interplay between physical discomfort and mental distress can create a vicious cycle, wherein ergonomic challenges exacerbate psychological symptoms, further compromising academic engagement and achievement.

Thus, the imperative to prioritize ergonomics in higher education extends far beyond mere comfort or convenience—it is a critical investment in the holistic health and success of college students. By acknowledging and addressing the ergonomic challenges faced by students, universities can cultivate environments that nurture physical health, mental resilience, and academic achievement. As we navigate the complexities of modern education, let us not overlook the profound impact that thoughtful ergonomic design can have on shaping the experiences and outcomes of college-going individuals.

Following this introduction, the paper will delve into a review of the literature concerning ergonomic challenges in higher education, highlighting gaps and limitations in existing research. Subsequently, it will present findings from a survey conducted among college students to elucidate prevalent ergonomic issues and perceptions. The paper will also analyze the implications of these findings and propose practical recommendations for improving ergonomic conditions on college campuses. Finally, the paper will conclude with reflections on the importance of prioritizing student ergonomics and directions for future research in this vital area.

Through this comprehensive exploration, this paper aims to shed light on an often overlooked aspect of student well-being and contribute to the development of effective ergonomic solutions tailored to the unique needs of college-going individuals.

Objectives

This research endeavours to explore the ergonomic challenges encountered by college-going students, ***aiming to***:

- Identify prevalent ergonomic risk factors and their impact on student health and performance.
- Examine existing ergonomic interventions and their applicability to the college setting.
- Propose solutions to enhance ergonomics in various learning environments, including classrooms, study spaces, and remote settings.

Hypothesis

Alternate Hypothesis

- College-going students will significantly facing health issues due to ergonomic challenges.

Null Hypothesis

- College-going students will not significantly facing on health due to ergonomic challenges.

Literature Review

Author (Year)	Research	Purpose	Result
Saliza mode Elias (2016)	Knowledge and practice of laptop ergonomics and provenance of musculoskeletal symptoms among university students.	The purpose is to access the knowledge and practice of laptops.	practice complete
G Sai Charan (2023)	Application of ergonomics and work study in an organization.	Purpose to identify the difficulties of the employee at the workplace.	identified the difficulties
Aloksander Zunjic (2015)	The role of ergonomics in the improvement of quality of education	The purpose is to consider the ways in which the ergonomics can contribute to the improvement of the quality of education.	purpose completed
Rosley jafar (2020)	Awareness of ergonomics among the engineering students.	The purpose of study is to find the level of ergonomics awareness among multidiscipline engineering students.	found the level of economics
Rakhshaan Khan, Ambreen Surti (2012)	Knowledge and practice of ergonomics in computer users.	Purpose to assess the knowledge and practices of ergonomics among desktop users of different professions.	practice complete
Usha Radhe (2018)	Assessment of knowledge of ergonomics among preclinical undergraduate students	Purpose of the present study was to assess the knowledge of ergonomics in preclinical undergraduate students.	study to access knowledge completed

Antonio-jose Dias-Caballero (2010)	Ergonomic factors cause the presence of pain muscle in dentistry students of dentistry.	Purpose to adopt inadequate postures to gain better vision of the oral cavity.	purpose complete
Swati Mishra (2013)	Posture Discomfort due to laptops among college going students.	Purpose of this ton encourages postural mal-alignment such as forward flexion of the neck and head.	purpose complete
Afreen khan (2017)	Ergonomics survey of computer science students: challenges at a workplace.	Purpose of this study was to assess the ergonomics of final year undergraduate and postgraduate students at the department of computer science.	purpose complete
Nasr Al- Hinai (2018)	An ergonomics student chair design and engineering for classroom environment.	Purpose of this to ensure better comfort and confidence for the students in the classroom environment.	purpose complete
Chetna Prakash Waradkar (2021)	Effectiveness of an ergonomic intervention program, in college students carrying backpack in a metropolitan city	This is designed to study the effectiveness of an ergonomic intervention program in college students carrying backpack in a metropolitan city	purpose complete

Methodology

The research was conducted in Gd Goenka University. The target group for this study included students of the university. In addition, the subjects from the target group had to be capable of reading the English language to understand and complete the questionnaire correctly. The survey was conducted by means of a questionnaire. The database was used for sending the questionnaires by email and whatsapp. A total of 122 emails were sent to students, 100 students were responded the questionnaire.

Inclusion

One hundred students were selected after applying the inclusion criteria: college going students with average attendance of more than 60% per year.

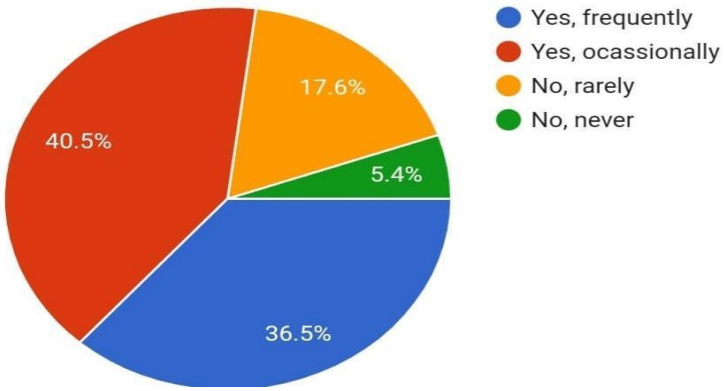
The overall objective of the research was to explore how ergonomic factors, such as poorly designed furniture or backpacks, influence the physical and mental well-being of students in their daily lives. It's important to note that

while the study provides valuable insights, some details remain unclear. The specific types of questions used in the survey, whether multiple choice, open ended, or a combination, are unknown. Additionally, the research doesn't specify whether the survey targeted particular ergonomic challenges, such as those related to backpacks, study environments, or computer use.

Results Analysis

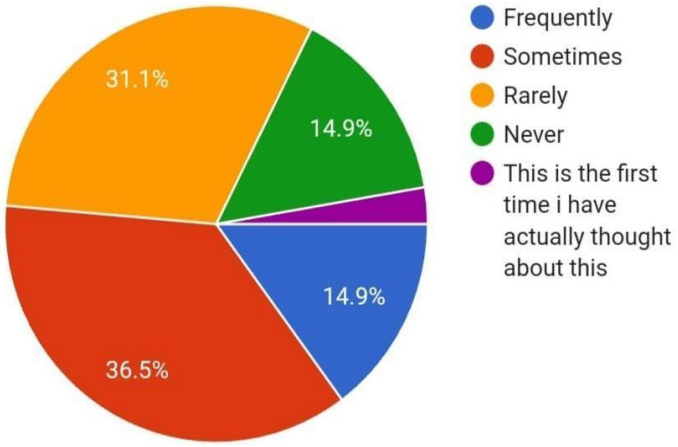
The sample size consisted of 100 students and of the total respondents provide insights into the extent that 40.5% students frequently experienced physical discomfort related to their study habits and technology usage whereas 36.5% students occasionally experienced discomfort. The data also suggested that 50% students are aware whereas 40% students are not fully aware about the risks of musculoskeletal disorders, fatigue, and reduced productivity due to poor ergonomics. Overall, the findings from these survey questions can provide valuable insights into the ergonomic challenges faced by college students and their impact on various aspects of students' lives, including physical health, mental well-being, academic performance, and social activities. The questions and their analysis of questionnaire are following:-

1. Do you experience any discomfort or pain in your neck, shoulders, back or wrists after prolonged sitting or using technology?



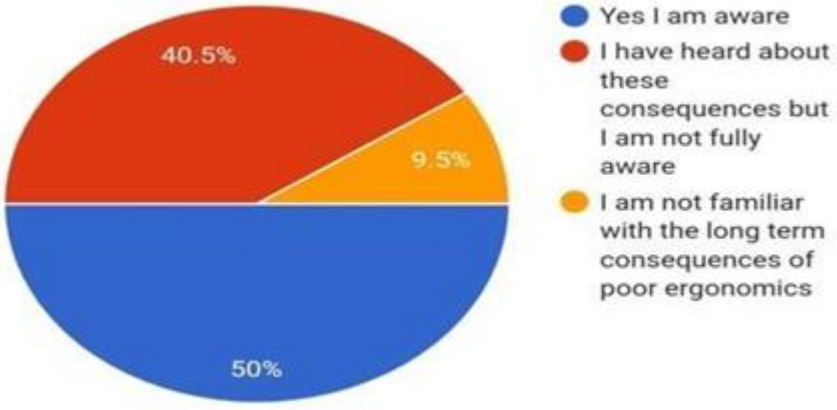
- This question aimed to assess the prevalence of musculoskeletal discomfort among respondents.
- The findings provide insights into the extent that 40.5% students experienced frequent physical discomfort related to their study habits and technology usage whereas 36.5% students occasionally experienced discomfort.

2. How often are you limited in your social activities due to the physiological symptoms?



- This question sought to understand the impact of physiological symptoms, such as pain or discomfort, on respondents' social lives.
- The result shows 36.5% students were impacted whereas 31.1% were rarely impacted by physiological symptoms, such as pain or discomfort, in their social lives.
- By examining the frequency of limitations in social activities, the results shaded light on the broader consequences of musculoskeletal issues on students' overall well-being and quality of life

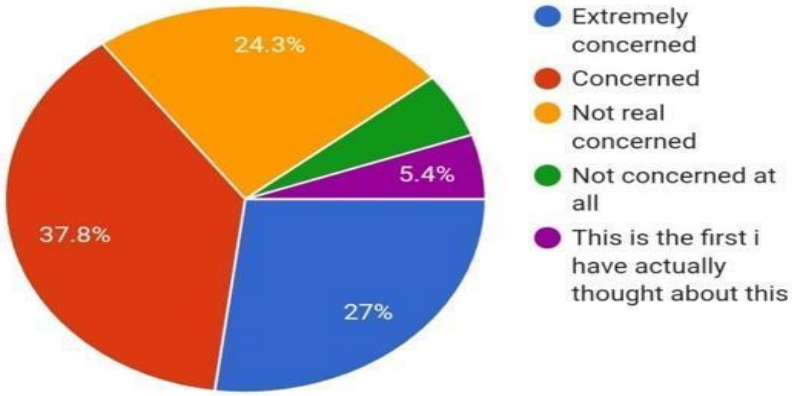
3. Are you aware of the long-term consequences of poor ergonomic practices such as musculoskeletal disorders, fatigue, and reduced productivity?



- This question aimed to gauge respondents' awareness of the potential consequences associated with poor ergonomic practices.
- The data suggested that 50% students were aware whereas 40% students were not fully aware about the risks of musculoskeletal disorders, fatigue, and reduced productivity due to poor ergonomics.
- Understanding the level of awareness among students regarding the risks of musculoskeletal disorders, fatigue, and reduced productivity could

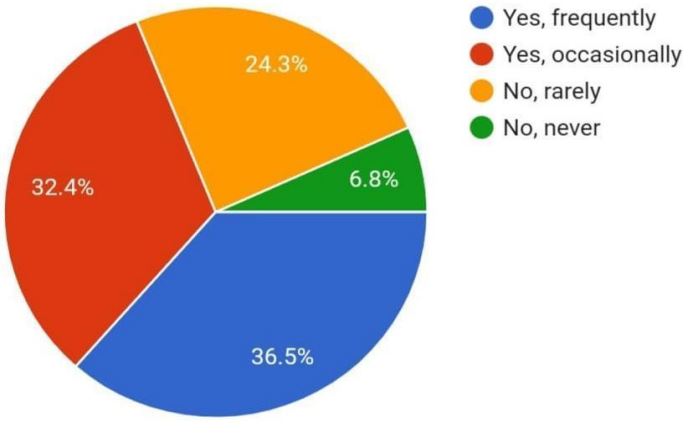
inform educational efforts and interventions to promote ergonomic awareness and practices.

4. Please select your level of concern about your future career and social life in your current physical state?



- This question assessed respondents' concerns about the impact of their current physical state, including any physiological symptoms or discomfort, on their future career prospects and social lives.
- The data suggested that 37% students are extremely concerned whereas 27% are also concerned about future career and social well being.
- The findings could reveal the perceived importance of physical well-being in relation to future goals and aspirations among students.

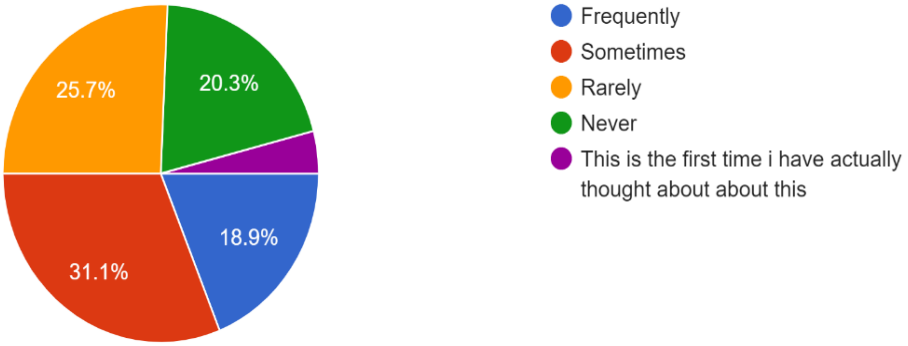
5. Do you experience eye strain or headaches after prolonged periods of screen time?



- This question aimed to explore the prevalence of visual discomfort, such as eye strain or headaches, resulting from prolonged screen time.

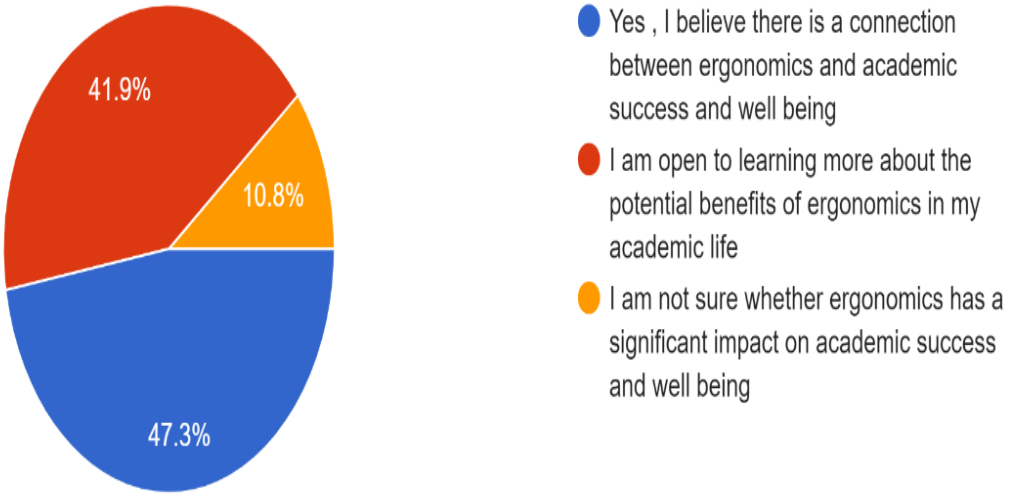
- The data suggested that 36.5% and 32.4% students experienced visual discomfort frequently and occasionally respectively.
- Understanding the frequency of these symptoms could highlight the importance of ergonomic considerations for visual health among students.

6. How often do your physiological symptoms affect your mental health?



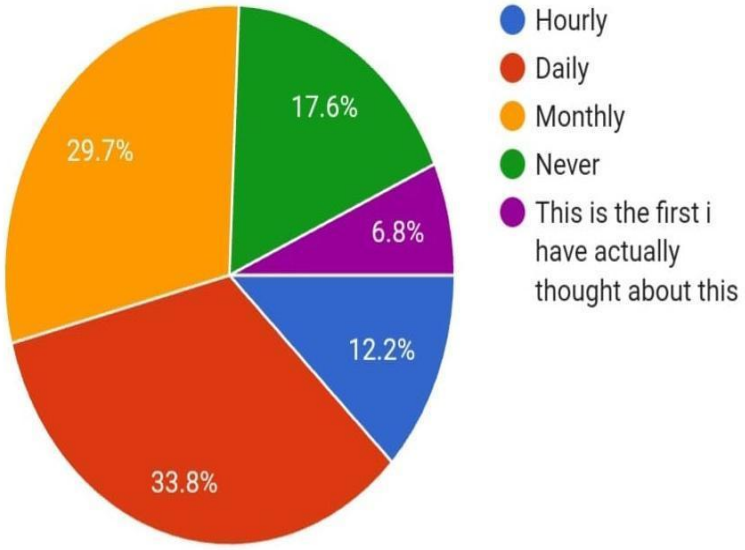
- This question sought to examine the relationship between physiological symptoms, such as pain or discomfort, and mental health outcomes among respondents.
- The data suggested that 31.1% students reported sometimes and only 18.9% students reported frequently being affected mentally by physiological symptoms, such as pain or discomfort.
- By assessing the frequency of mental health impacts, the results could underscore the interconnectedness of physical and mental well-being in the context of ergonomic challenges.

7. Do you believe that integrating ergonomic principles into your study habits could improve your academic performance and overall well-being?



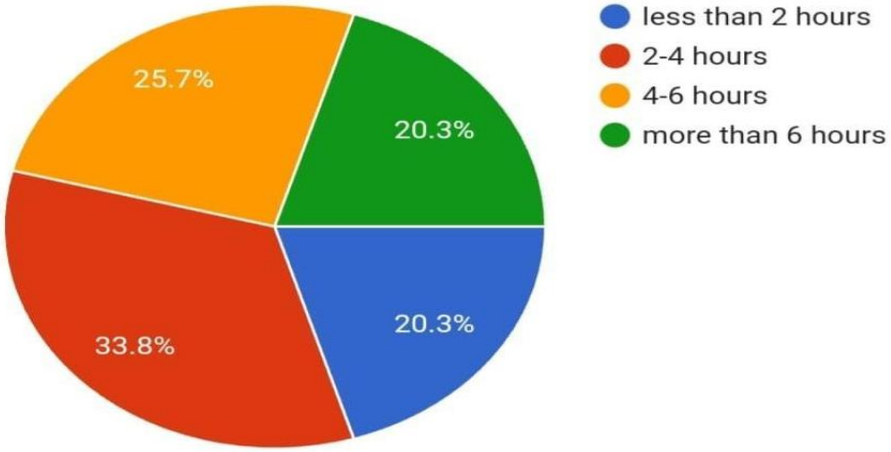
- This question aimed to gauge respondents' beliefs regarding the potential benefits of integrating ergonomic principles into their study habits.
- The data suggested that 47.3% students believed that there is a connection between ergonomics and academic success and wellbeing, whereas 41.9% students don't know about potential harms of poor ergonomics and its relation to academics.
- Understanding students' perceptions helped to inform efforts to promote the adoption of ergonomic practices and enhance academic performance and well-being.

8. How often do the physiological symptoms affect your ability to concentrate in class and retain information?



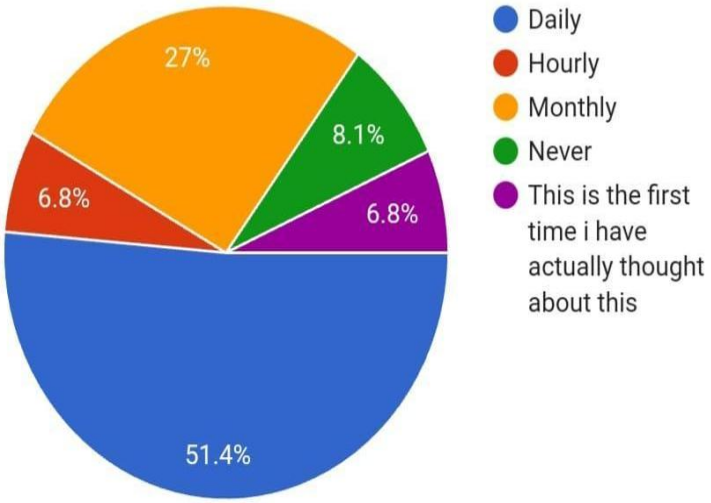
- This question aimed to assess the impact of physiological symptoms on respondents' cognitive functioning, specifically their ability to concentrate in class and retain information.
- The data suggested that 33.8% students are struggling daily in concentration and learning due to physiological symptoms, whereas 12.2% students are struggling hourly also, and 29.7% students get impacted monthly.
- The findings could highlight the implications of ergonomic challenges for academic success and learning outcomes.

9. On average how many hours per day do you spend sitting at a desk studying or using technology?



- This question sought to quantify respondents' daily sitting behavior related to studying or using technology.
- Understanding the duration of sedentary activities could provide insights into potential risk factors for musculoskeletal issues and inform recommendations for promoting physical activity and breaks.
- The data suggested that 33% of the students prefer sitting between 2-4 hours a day for studying and around 25% of the students prefer 4-6 hours.

10. How often do you experience the physiological symptoms of poor posture while in class or doing homework?



- This question aimed to assess the frequency of physiological symptoms associated with poor posture during academic activities.

- By examining the prevalence of these symptoms, the results could highlight the importance of promoting ergonomic awareness and practices in educational settings.
- The data suggested that more than 50% of the students face physiological symptoms daily and 27% of the students face physiological symptoms monthly.

Discussion

The research discusses the often-overlooked physiological aspects and movements in ergonomics, emphasizing the potential for early intervention to mitigate musculoskeletal pain. It highlights challenges in correcting embedded bad habits and the lack of recognition of ergonomics as a standard by governing agencies and corporate entities. The financial costs of musculoskeletal injuries on a corporate level are emphasized, along with the importance of addressing ergonomic-related injuries within organizations. The text suggests that college students, facing sedentary lifestyles, may develop future physiological problems, emphasizing the need for awareness and prevention of poor habits.

Research indicates varying levels of awareness regarding ergonomics among different populations. While our study found that 25% of participants had prior knowledge of ergonomics, a study conducted among computer users in Karachi reported a higher awareness rate of 52.33%. This disparity could be attributed to differences in sample populations. Similarly, another study highlighted the importance of addressing computer system usage, musculoskeletal issues, and visual disorders, emphasizing the critical role of organizational support in safeguarding the health and safety of computer workers.

Our findings revealed that a majority of students spent 3-5 hours daily in front of a computer, with a significant portion devoting 6-12 hours and a smaller percentage exceeding 15 hours. Comparatively, research conducted among employees in Ghana reported higher average daily computer usage. However, it's worth noting that our study may have underestimated computer usage due to potential underreporting. Additionally, insights from a study on university students' laptop usage indicated varying rates of external accessory utilization, with a considerable proportion using external mice and a smaller percentage employing external monitors or laptop risers.

In summary, promoting awareness of ergonomics and encouraging the adoption of ergonomic practices can significantly enhance the health, safety, and productivity of individuals, particularly those engaged in prolonged computer usage.

Conclusion

The study revealed a lack of knowledge about ergonomic practices. Those who are aware still don't know how to carefully apply this for the prevention of health hazards. Many students grapple with medical issues, often experiencing pain and discomfort as a result. This situation frequently arises due to a lack of application of ergonomic principles in their work environments, whether at college, home, or in hostels.

The data suggested that 50% students were aware whereas 40% students were not fully aware about the risks of musculoskeletal disorders, fatigue, and reduced productivity due to poor ergonomics. Understanding the level of awareness among students regarding the risks of musculoskeletal disorders, fatigue, and reduced productivity could inform educational efforts and interventions to promote ergonomic awareness and practices.

It's essential for educational institutions to raise awareness about the importance of ergonomics and provide resources and guidance to help students create ergonomically sound work environments. Similarly, students must take proactive measures to educate themselves and integrate ergonomic principles into their daily routines to safeguard their health and academic performance.

Limitations

- **Age Group Focus:** This research primarily focuses on college-going students aged between 18 to 25 years old. Therefore, findings and recommendations may not be applicable to individuals outside of this age range.

- **Generalizability:** Due to the narrow focus on college students within a specific age group, the findings of this study may not be generalizable to other age groups or populations. Ergonomic challenges faced by individuals outside of the targeted age range may differ significantly due to varying lifestyle factors and physical characteristics.

- **Exclusion of Other Age Groups:** The study does not encompass ergonomic challenges faced by individuals outside of the specified age group. Consequently, insights into the ergonomic needs and concerns of different age demographics, such as younger adolescents or older adults, are not addressed within this research.

- **Lifestyle Variability:** Different age groups may exhibit distinct lifestyles, habits, and ergonomic requirements. By solely concentrating

on college students aged 18 to 25, this study may overlook pertinent ergonomic considerations present in other age cohorts.

- **Lack of Comprehensive Comparison:** Owing to the exclusion of alternative age groups, this research lacks a comprehensive comparative analysis of ergonomic challenges across different demographic segments. Consequently, the study's findings may be limited in their scope and applicability to broader populations.

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Evaluation of Burnout Syndrome Prevalence in College-Going Population

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Abstract

A condition of extreme physical, mental, and emotional tiredness brought on by extended exposure to stressors—especially at work—is known as burnout syndrome. Burnout usually occurs gradually over time and is mostly caused by ongoing work-related stress; however, it can also be brought on by other things, such as pressures in one's personal life or a lack of support from coworkers. College students are not exempt from the effects of burnout syndrome; symptoms are comparable to those seen in the workplace but have certain particular traits. The intense demands of coursework, extracurricular activities, part-time employment, and social pressures can lead to student burnout in a college context. Assessing the prevalence of burnout syndrome among college-bound students is the study's goal. A cohort of eighty individuals was carefully chosen using a purposive sample approach to guarantee representational variety in the study. The university research setting offered a favorable atmosphere for gathering and analyzing data. A wide range of resources was used, including painstakingly crafted Kessler Psychological Distress Scale surveys. In this study, as a result, the author found that college-going students suffered from high levels of psychological distress with a mean score value of 25.275 which lies in the high distress category in the Kessler Psychological Distress Scale. Preventing and managing burnout in college requires a combination of self-care strategies and support from academic institutions and peers. Students can benefit from learning effective time management skills, setting realistic goals, seeking help when needed, maintaining a healthy work-life balance, and engaging in activities that promote relaxation and well-being. Colleges and universities can also play a role by providing resources such as counseling services, academic support programs, and opportunities for social connection and community involvement. By addressing the underlying causes of burnout and fostering a supportive environment, colleges can help students thrive academically and emotionally.

Introduction

Burnout Syndrome (BOS) is a prominent social and health issue that mostly affects workplaces. Due to the emergence of research in other

professional domains and, more recently, studies involving undergraduate university students, this field of study has experienced significant global expansion (Rosales-Ricardo *et al.*, 2021; Galen *et al.*,2011; Montero-Marin *et al.*, 2011) Although there isn't yet a widely recognized definition of burnout, the most widely used one: is a mental illness characterized by emotional fatigue, depersonalization, and a decrease in one's sense of personal achievement that can happen to people who work with other individuals in some capacity (Galen *et al.*,2011). Depression and burnout are now major mental health issues in medical schools. A growing amount of research demonstrates that aspiring medical professionals experience dangerously high rates of depression and burnout and that these problems persist even after they graduate and enter the workforce (Mousa *et al.*, 2016). In the context of burnout and quality of life, a person-oriented approach might, first, foster an appreciation of students as distinct persons by taking into account the myriad aspects of burnout and quality of life that each student experiences, as opposed to focusing on each aspect alone(Kusurkar *et al.*, 2013). Depersonalization is a symptom of emotional tiredness, which is exhibited by emotional depletion from overwork, decreased professional efficacy, a term unique to the human services sector, is a diminished sense of competence or accomplishment in one's work, and sensation of being unfeeling toward patients or peers (typically unpleasant, callous, and distant attitudes).

Medical students' academic lives might be viewed as psychologically hazardous, with the majority of stress stemming from the requirements of the curriculum (Yusoff *et al.*, 2010; Yusoff *et al.*, 2013; Yen *et al.*, 2013; Dyrbye *et al.*, 2016); A recent meta-analysis that showed a significant prevalence of depression provides proof for this; The estimated prevalence among medical students worldwide was 28.0% (24.2%–32.1%) (Puthran *et al.*, 2016). Studies show that college students are not immune to burnout, as they too may encounter similar signs of fatigue and disengagement from their studies. Students who suffer from study tiredness, a sign of academic burnout, report feeling worse about themselves, being less satisfied with life, being less engaged in their studies, and less proficient with job duties in their first year of employment. After graduating from college, these people frequently expressed disinterest in their careers, felt ill-prepared, and were more likely to quit their jobs. Conversely, in a study of international college students who performed better academically, felt motivated by their work, and were competent in their studies also reported feeling less burned out and more engaged. (Rudman *et al.*, 2012; Schaufeli *et al.*, 2002). The COVID-19 epidemic has highlighted issues related to the mental well-being of a number of impacted groups. Epidemics are known to intensify or introduce new stressors, such as anxiety and concern for oneself or one's loved ones, limitations on movement and social interactions because of quarantine, and abrupt and drastic changes in lifestyle. Nevertheless,

there is little proof of the psychological or mental health consequences of the present pandemic on college students, who are considered to be a sensitive demographic (Bruffaerts *et al.,* 2018), with the exception of a few studies, particularly from China (Cao *et al.,* 2020; Liu *et al.,* 2020; Wang *et al.,* 2020). Even while the results of all of this research point to a rise in mental health problems among college students, it's possible that the underlying factors aren't universally applicable to populations abroad. The urgent necessity to evaluate the impact of the present epidemic on college student's mental health and well-being has been emphasized in a number of recent correspondences (Zhai *et al.,* 2020; Zhai *et al.,* 2020; De Oliveira Araujo *et al.,* 2020; Holmes *et al.,* 2020). Students may find their first year of university to be quite difficult (Hassel *et al.,* 2018; Knoesen *et al.,* 2018). Students may experience significant levels of stress that could result in emotional tiredness due to a variety of causes, including the transition from secondary school to university, the pressure to perform well on tests and jobs, the absence of family support, and economic factors (Trigueros *et al.,* 2020). Studies conducted in Spain have examined the prevalence of burnout among PhD students (Sorrel *et al.,* 2018) as well as undergraduate students (Trigueros *et al.,* 2020; Schaufeli *et al.,* 2002; De la Fuente *et al.,* 2020; Duran *et al.,* 2006; Salanova *et al.,* 2005; Martinez *et al.,* 2020; Navarro-Abal *et al.,* 2018; Carvalho *et al.,* 2018). The connection between university students' psychological distress and burnout has not been examined in any of this research. To the best of our knowledge, there isn't much research comparing university students' academic achievement, academic burnout, and psychological symptoms.

Literature Review

Moreno-Jiménez, *et al.,* (2008), suggest that the generalization of the syndrome in the undergraduate student academic environment arises from the presumption that these students, like any other professional, confront pressures and work overloads typical of the academic field. The aforementioned students, like any other employee, maintain a direct and indirect compensation relationship with their university, evidenced by financial support, scholarships, awards, or prizes. This presumption allows us to investigate the individual's responses to stress and its implications for this group of students who are not able to be completely successful in their studies.

Gil-Monte et al.,(2005), found that according to several studies, the most common manifestations of BOS in students are physical and mental exhaustion, dropping out of school, and decreased academic performance.

Martínez Martínez et al., (2002), suggest that students with high levels of burnout are exhausted by the demands of study, have a cynical and distant attitude toward schooling, and feel ineffective as students.

Chunming et al.,(2017)discovered that gender could be an influence as a significant predictor of burnout or it is at least one of its constructs, with male students experiencing a greater degree of suffering than female students. The emotional exhaustion in men tends to be significantly higher than in women.
Santen et al. (2010), several factors may contribute to burnout of medical students, including curricular factors, personal life events, and the learning environment.

Dyrbye et al.;(2008) lead to important consequences such as unprofessional conduct, increased risk of suicidal ideation, and serious thoughts of dropping out. In this study the author proposed that there is good news the burnout in medical students may be reversible, and approximately 26% of them can be recovered within a year.

Maslach C et al.; (1998); traditionally, burnout syndrome has been defined as a situation in which the affected person experiences feelings of "emotional fatigue", "depersonalisation", and "lack of personal achievement". "Emotional fatigue" prevents workers from engaging in their work at an emotional level due to their perceived lack of energy. "Depersonalisation" refers to the development of negative feelings and behaviour towards other people, and often involves blaming others for one's own problems. "Lack of achievement" refers to the tendency to assess one's own ability negatively and involves feelings of unhappiness and dissatisfaction.

Botti G et al.; (2011), among university students, burnout syndrome has been found to be especially prevalent in those training for health careers, such as medicine and nursing.

Gorter RC et al.; (2007), Burnout syndrome has been found to be most severe when dentists make their first step into the professional world. Therefore, dental universities have been advised to incorporate the instruction of stress management skills into their programs.

Montero-Marín J et al. ;(2011)The dimensions 'overload', 'lack of development, and 'neglect', belonging to the "frenetic", under-challenged" and "worn-out" subtypes, respectively, comprise a definition of burnout that comes close to the standard and typological approaches.

Research Gap

Burnout syndrome is a pervasive issue affecting individuals across various professions and age groups. While extensive research has been conducted globally to understand and mitigate burnout, there exists a noticeable gap in the literature, particularly concerning the college-going population in India. Despite the prevalence of academic stress and socio-cultural factors unique to the Indian context, there is a dearth of studies addressing burnout syndrome among this demographic.

The decision to undertake this research is motivated by the absence of empirical studies exploring the phenomenon within the specific cultural, educational, and societal context of India.

The college-going population in India faces a distinctive set of challenges, encompassing academic pressure, societal expectations, and career-related stressors. Moreover, cultural nuances and the Indian educational system's structure may contribute to the manifestation of burnout in ways that differ from Western societies. Despite these unique circumstances, the literature lacks a nuanced understanding of burnout's intricacies in the Indian college context.

By addressing this research gap, our study aims to provide valuable insights into the prevalence and nature of burnout among college students in India.

Objectives

The objective of the study is to evaluate the prevalence of burnout syndrome in the college-going population.

Hypothesis

Null hypothesis: There will be no prevalence of burnout syndrome in the college-going population.

Alternate hypothesis: There will be a prevalence of burnout syndrome in the college-going population**.**

Research Methodology

A survey-based methodology was employed in this study conducted at GD Goenka University, focusing on individuals aged 18 to 25, encompassing both males and females proficient in written and spoken English. Employing purposive sampling, a sample size of 80 participants was selected. The study utilized the Kesler Psychological Distress Scale questionnaire as its primary material.

The Kessler Psychological Distress Scale (K10) is a widely used 10-question screening tool designed to identify individuals experiencing psychological distress. Each question asks about emotional states in the past 4 weeks, with a 5-point answer scale ranging from "none of the time" to "all of the time." Scores are summed, with a minimum of 10 and a maximum of 50. Lower scores indicate lower distress, while higher scores suggest potentially needing further evaluation. The K10 demonstrates good reliability and validity, meaning it consistently measures what it's designed to and accurately reflects underlying psychological distress. Scores of 19 and under typically suggest low distress; 20-24 indicate mild distress, 25-29 moderate distress, and 30 and over suggest severe distress. However, the K10 is a screening tool, not a diagnostic one.

Reliability of the K10: The Kessler Psychological Distress Scale has demonstrated strong reliability in numerous studies. It has been shown to have high internal consistency, with Cronbach's alpha coefficients typically ranging from 0.82 to 0.93, indicating that the 10 items on the scale are closely related and measure the same underlying construct. The test-retest reliability of the K10 has also been found to be excellent, with correlation coefficients ranging from 0.79 to 0.86 over time periods ranging from 2 to 4 weeks.

Validity of the K10: The Kessler Psychological Distress Scale has been extensively validated in various populations and settings. Studies have consistently shown that the K10 has strong convergent validity, meaning that it correlates highly with other measures of mental health and well-being, such as the General Health Questionnaire (GHQ) and the Patient Health Questionnaire (PHQ).

Overall, the Kessler Psychological Distress Scale is a highly reliable and valid instrument that has been widely adopted in both research and clinical practice as a valuable tool for assessing and monitoring psychological distress (Kessler *et al.*, 2003).

Results

Studies reveal a concerning prevalence of burnout syndrome among college students. The author analyzed the data and calculated an average mean score of 25.275. On the Kessler Psychological Distress Scale (K10), this score typically signifies high psychological distress. The K10 is a widely recognized tool for assessing psychological distress, with a scoring range from 10 to 50. Higher scores indicate greater levels of distress, with scores between 20 and 24 suggesting mild distress, while scores above 25 indicate high distress.

A mean score of 25.275 suggests that the majority of students are experiencing significant psychological distress. This high level of distress is likely attributable to the intense demands placed on students, which include rigorous coursework, involvement in extracurricular activities, part-time employment, and social pressures. These factors combine to create a challenging and often overwhelming environment, leading to widespread burnout.

Moreover, the high prevalence of psychological distress among college students can have serious implications for their mental health and academic performance. Chronic stress and burnout can lead to a range of negative outcomes, including anxiety, depression, and decreased academic achievement. It can also affect students' physical health, leading to issues such as sleep disturbances and weakened immune systems.

To address this issue, it is crucial for colleges and universities to provide adequate support services for students. This could include mental health counseling, stress management workshops, and programs designed to promote a healthy work-life balance. By recognizing the severity of the problem and taking proactive steps to support student well-being, educational institutions can help mitigate the effects of burnout and create a more supportive and sustainable academic environment.

Conclusion

Burnout is a serious issue for college students, but there are ways to help. Colleges should offer support like counselling and stress management programs. By taking care of student’s mental health and creating a supportive environment, so that everyone together can make college a better experience for everyone.

Limitations

The study's limited sample size, comprised solely of participants from a single university, hinders the ability to extrapolate the findings to a wider population. To enhance the study's external validity, future research should aim for a more diverse sample, incorporating participants from multiple institutions. This approach would contribute to a more comprehensive understanding of the phenomenon being examined.

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Healthcare Awareness among Students

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Abstract

This prospective cross-sectional study employs a survey quantitative research method to delve into the realm of healthcare awareness among students currently enrolled at GD Goenka University, located in Gurgaon. Through meticulous application of simple random sampling, a sample size ranging between 50 to 70 students is carefully selected; ensuring each individual within the population has an equal opportunity of inclusion, thereby providing a representative snapshot of the student community's healthcare preferences.

Central to this investigation is the utilization of a structured questionnaire, meticulously crafted with 10 items aimed at probing various facets of healthcare awareness. These items are meticulously designed to gauge students' understanding, perception, and attitudes towards healthcare services, encompassing topics such as preventive measures, access to healthcare facilities, and health-seeking behaviors.

By meticulously adhering to rigorous sampling techniques and employing a carefully constructed questionnaire as the primary research instrument, this study aims to unearth nuanced insights into the healthcare awareness landscape among students within an academic environment. It endeavors to shed light on potential gaps in knowledge, identify areas for improvement, and inform the development of targeted healthcare education interventions tailored to the needs of the student populace.

Through the dissemination of its findings, this study seeks to catalyze discussions, initiatives, and policies geared towards enhancing healthcare literacy and fostering a culture of proactive health management among young adults. Ultimately, the insights garnered from this research endeavor hold the potential to empower students to make informed healthcare decisions, thereby contributing to the promotion of overall health and well-being within the academic community and beyond.

Keywords: Potential, health, catalyzes questionnaire, gauge and healthcare.

Introduction

Healthcare awareness is all about understanding the importance of health and wellness, and how to achieve it. It covers a broad range of topics, from disease prevention and early detection, to proper nutrition and exercise, mental health, and even the importance of regular check-ups and screenings. The goal is to empower individuals with the knowledge they need to make informed decisions about their health. It's about promoting healthy habits and attitudes that lead to improved overall health and well-being. In doing so, we aspire to contribute to the broader goal of creating health and more resilient communities.

It starts with understanding the basics of our bodies, how they function, and what they need to stay healthy. This includes a balanced diet, regular exercise, adequate sleep, and regular check-ups. It involves being aware of various diseases and conditions, their symptoms, and prevention methods. Early detection can be a lifesaver. it's about making informed health decisions and adopting healthy habits, It's a continuous process, but with each step, we get closer to a healthier life. Healthcare surveys serve as invaluable tools in understanding the intricacies of patient experiences within the healthcare system. (1,2) They provide a structured approach to gather systematic information directly from patients, allowing healthcare providers, policymakers, and researchers to gain insights into various aspects of healthcare delivery.

These surveys cover a wide range of topics, including but not limited to, patient satisfaction, quality of care, accessibility of services, effectiveness of treatments, communication with healthcare professionals, and overall healthcare experiences.

By administering structured questionnaires to a representative sample of patients, healthcare surveys collect data that can be analyzed quantitatively and qualitatively. Quantitative analysis involves statistical methods to identify trends, patterns, and correlations within the data, while qualitative analysis delves deeper into the narratives and personal experiences shared by patients. Together, these approaches provide a comprehensive understanding of the strengths and weaknesses of healthcare systems, as well as areas for improvement. (3)

One of the primary goals of healthcare surveys is to identify areas where healthcare services may not be meeting patient needs or expectations. This could include issues such as long wait times, difficulty accessing specialists, lack of communication between healthcare providers and patients, or concerns about the affordability of care. By pinpointing these areas of concern, healthcare

providers and policymakers can implement targeted interventions to address gaps in service delivery and improve overall patient satisfaction. (4)

Furthermore, healthcare surveys play a vital role in monitoring changes and trends in patient experiences over time. By conducting surveys at regular intervals, healthcare organizations can track progress towards goals, evaluate the impact of quality improvement initiatives, and make informed decisions about resource allocation and strategic planning.

In essence, healthcare surveys are essential tools for gathering insights directly from patients, which are crucial for shaping policies, improving healthcare delivery, and ultimately enhancing the quality of care provided to individuals and communities. Through the systematic collection and analysis of patient feedback, healthcare surveys empower stakeholders to make evidence-based decisions that prioritize patient-centered care and contribute to better health outcomes for all. (5, 6)

Why is the health care survey important?

Healthcare surveys serve as vital instruments for collecting comprehensive feedback directly from patients, offering a nuanced understanding of their experiences, preferences, and needs within the healthcare system. Here's a deeper elaboration on the significance of healthcare surveys:

1. **Enhancing Patient-Centered Care:** By centering on patient perspectives, healthcare surveys facilitate the delivery of patient-centered care. They enable healthcare providers to tailor services to meet individual needs, preferences, and expectations, ultimately fostering a more personalized and responsive healthcare experience.

2. **Driving Continuous Quality Improvement:** Healthcare surveys provide a mechanism for continuous quality improvement within healthcare organizations. By identifying areas of strengths and weaknesses, as well as gaps in service delivery, surveys enable healthcare providers to implement targeted interventions, refine processes, and enhance the overall quality of care.(7)

3. **Fostering Accountability and Transparency:** Transparent communication and accountability are essential components of effective healthcare delivery. Healthcare surveys promote transparency by soliciting feedback from patients and holding healthcare organizations accountable for their performance. This fosters trust between patients and providers and promotes a culture of accountability within the healthcare system.

4. **Informing Evidence-Based Decision Making:** The data collected through healthcare surveys serve as valuable evidence for decision making at various levels within healthcare organizations. Whether it's resource allocation, policy development, or strategic planning, survey findings offer actionable insights that inform evidence-based decision making, leading to more effective and efficient healthcare delivery.(8)

5. **Empowering Patient Advocacy:** Healthcare surveys empower patients to advocate for their own healthcare needs and preferences. By providing a platform for patients to voice their concerns and feedback, surveys empower individuals to actively participate in shaping their healthcare experiences, driving positive change within the healthcare system.(9)

6. **Supporting Research and Innovation:** Healthcare surveys contribute to the body of knowledge in healthcare research and innovation. The data collected from surveys can inform research studies, clinical trials, and innovation initiatives aimed at improving healthcare outcomes, developing new treatments, and advancing medical knowledge.

7. **Promoting Equity and Inclusivity:** Healthcare surveys play a role in promoting equity and inclusivity within the healthcare system by ensuring that the voices of all patients, including those from marginalized or underserved communities, are heard and considered. By addressing disparities in access to care and healthcare outcomes, surveys contribute to advancing health equity and social justice.(10,11)

Literature Review

Title	Author Name	Published
National health survey and the behavior model of health service use	RM Andersen	2008
Demographic and health surveys	DJ corsi, M Neuman, JE Finlay	2012
National mental Health survey of india	RS Murthy	2017
WHO Mental health survey	RC Kessler, TB Ustun	2008
Oral Health survey	PE Petersen, RJ Baez	2013

sample design of the national population health survey	JL Tambay, G catlin	1995
Health survey for England	N Bennett, T Dodd, J flately, S Freeth, K Bolling	1995

Objectives of the Study

The aim of this research is to know the patient's level of healthcare awareness about common healthcare issues, knowledge about preventive measures, healthy lifestyle practices and utilization of healthcare services.

1. **Cultural Influence:** This objective seeks to investigate the impact of cultural backgrounds on healthcare attitudes and engagement. By examining how cultural norms, beliefs, and practices shape individuals' perceptions of health and healthcare, the study aims to uncover cultural-specific factors that may influence healthcare awareness and utilization.

2. **Intersectional Dynamics:** The study aims to explore how socioeconomic and cultural factors intersect to influence health-related behaviors. By considering the complex interplay between factors such as income, education, race, ethnicity, and cultural background, the research seeks to identify nuanced patterns and disparities in healthcare awareness and engagement across diverse populations.

3. **Strategic Recommendations:** This objective focuses on identifying inclusive strategies for healthcare awareness initiatives that are tailored to diverse cultural and socioeconomic contexts. Drawing upon insights from cultural studies, sociology, and healthcare, the study aims to develop actionable recommendations for healthcare providers, policymakers, and community organizations to effectively promote healthcare awareness and engagement across diverse populations.

4. **Comprehensive Understanding:** By synthesizing insights from cultural studies, sociology, and healthcare, this objective aims to enhance overall understanding of the dynamics of healthcare awareness. By examining the intersections between culture, socioeconomic status, and healthcare, the study seeks to provide a comprehensive analysis of the factors influencing healthcare attitudes and behaviors.

5. **Policy Contribution:** The study aims to provide evidence-based recommendations for healthcare policies that prioritize inclusivity and aim to improve public health outcomes. By highlighting the importance of considering cultural and socioeconomic factors in healthcare policy development, the research seeks to inform policy decisions that are responsive to the needs of diverse populations and contribute to the promotion of health equity.

Research Methodology

1. **Type of Research:** The research employs prospective cross-sectional design based on survey quantitative research method to investigate about healthcare awareness among population.

2. **Sample:** The sample population consists of students currently enrolled in GD Goenka University, Gurgaon.

3. **Type of Sampling:** Simple random sampling technique will be utilized to ensure each student in the population has an equal chance of being selected for the study.

4. **Sample Size:** The sample size is estimated to range between 50 to 70 students, aiming to provide a representative snapshot of the student population's preferences.

5. **Tools to be used:** A structured questionnaire will serve as the primary tool for data collection. A 10 item structured questionnaire was used as the research instrument.

Research Gap

1. **Digital Health Survey Tools:** With the rise of digital health technologies, there's a need for surveys that assess the impact of digital interventions, mobile health apps, telemedicine, and wearable devices on healthcare outcomes. Research in this area can help identify best practices for integrating digital health tools into patient care.

2. **Patient Experience and Satisfaction:** While patient-reported outcomes are increasingly recognized as important indicators of healthcare quality, there may be gaps in understanding patient experiences, satisfaction, and preferences across different healthcare settings and specialties. Surveys focusing on patient-centered care can help address this gap.

3. **Health Literacy andSurveyDesign:** Healthcare surveys often assume a certain level of health literacy among respondents, which may not be appropriate for all populations. Research is needed to develop and validate survey instruments that are accessible and understandable to individuals with varying levels of health literacy.

Observation and Result

In this study, a sample size totaling 50 to 70 participants was included, and a questionnaire focusing on the awareness of healthcare services was distributed. The responses gathered are as follows:

Table 1: Age group

Age group distribution	
Under 18	4%
18-30	93%
31-50	3%

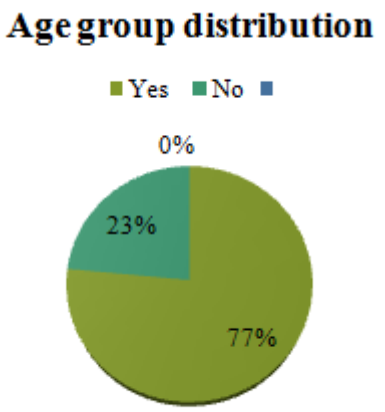


Table 2: Gender Distribution

Gender Distribution	
Male	**60%**
Female	**38%**
Non binary	**2%**

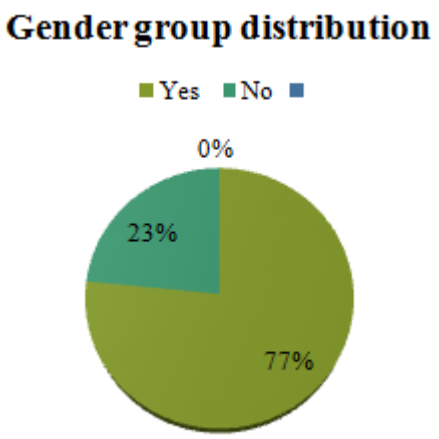


Table 3: Healthcare utilization ratio

Healthcare Utilization Ratio	
Yes	90%
No	10%

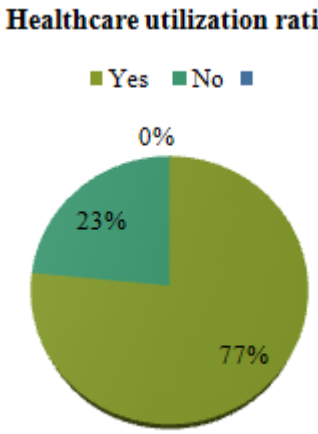
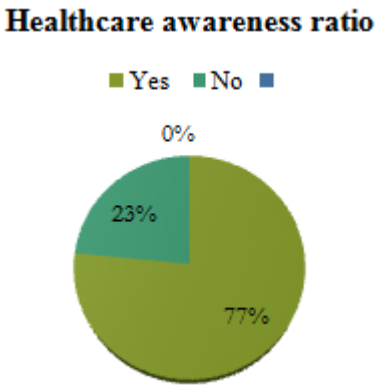


Table 4: Healthcare awareness ratio

Healthcare utilization ratio	
Yes	76%
No	23%



The survey results provide intriguing insights into the healthcare behaviors, preferences, and satisfaction levels among young adults aged 18-50 within the community. Notably, the demographic breakdown revealed a predominantly young adult population, with males slightly outnumbering females, constituting 60.3% and 38.4% of the participants, respectively. This demographic composition reflects a substantial representation of the youth demographic, offering a pertinent glimpse into this specific age group's healthcare engagement.

Of particular interest is the high rate of healthcare utilization observed among the surveyed participants, with an overwhelming 90.4% reporting visits to healthcare providers within the past year. This finding underscores the significance of healthcare services in the lives of young adults, indicating a proactive approach to managing their health and seeking medical attention when needed.

Further analysis of the types of healthcare services accessed by the participants reveals diverse patterns of healthcare utilization. Half of the respondents opted for hospitals or clinics, highlighting the significance of primary care settings in meeting young adults' healthcare needs. Additionally, a notable proportion utilized pharmacy services (22%), consulted specialists (11%), or accessed a combination of these services (16.4%). This diversity in healthcare utilization suggests a multifaceted approach to managing health concerns, with individuals seeking services tailored to their specific needs and preferences.

The satisfaction levels among the surveyed participants reflect a generally positive outlook towards the healthcare services received. A substantial 61.6% expressed satisfaction, with an additional 28% indicating a high level of satisfaction. While a minority remained neutral (9.6%), the overall satisfaction rates underscore the effectiveness of healthcare services in meeting the expectations and needs of young adults within the community.

Moreover, the survey findings highlight a commendable level of awareness regarding preventive healthcare services among the respondents, with 76.7% indicating awareness of available preventive healthcare services in their area. This awareness underscores a proactive approach to healthcare management, with young adults recognizing the importance of preventive measures in maintaining their well-being and health.

The survey results offer valuable insights into the healthcare engagement, preferences, and satisfaction levels among young adults aged 18-20 within the community. The findings underscore the significance of healthcare services in the lives of young adults, revealing patterns of utilization, satisfaction levels, and awareness of preventive healthcare services. These insights provide a foundation for informed decision-making and targeted interventions aimed at enhancing healthcare access, quality, and satisfaction among young adults in the community.

Conclusion

The active engagement of young adults in seeking and utilizing healthcare services within their community is a promising indicator of a proactive approach to health management. Hospitals and clinics serving as the primary destinations for these individuals suggest a level of accessibility and trust in the local healthcare infrastructure.

The high satisfaction rates among these young adults signify that the services provided meet their expectations and likely address their healthcare needs effectively. This satisfaction is crucial for maintaining a positive attitude towards healthcare and encouraging continued utilization of services when needed

The elevated awareness about preventive healthcare services among young adults is particularly encouraging. It indicates that public health messages are effectively reaching this demographic, potentially through targeted campaigns, educational initiatives, or digital platforms tailored to their preferences. By being proactive about their health through preventive measures, these individuals are laying the groundwork for better long-term health outcomes.

This trend not only benefits the individuals themselves but also contributes to the overall health and well-being of the community. As young adults take advantage of preventive services, they are likely to reduce the burden on healthcare systems by preventing or mitigating the onset of illnesses and chronic conditions.

Furthermore, the success of these efforts reflects positively on healthcare providers and stakeholders within the community. It underscores their commitment to delivering accessible, high-quality healthcare services and their ability to engage effectively with the younger demographic.

Overall, the active participation of young adults in healthcare services, coupled with high satisfaction and a focus on prevention, bodes well for the community's health awareness and future health outcomes. It highlights the importance of continued investment in preventive healthcare initiatives and underscores the potential for positive change when individuals are empowered to take control of their health.

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Prevalence of Functional Disability Due to Neck & Back Pain among GD Goenka Staff

Divya Goyal, Samuel, P Aditya Balaji, Urvashi, Soni Yadav
GD Goenka University

Abstract

Introduction: Neck and back pain are common musculoskeletal complaints that can significantly impact an individual's functional ability and quality of life. Understanding the prevalence of functional disability associated with neck and back pain among university staff is essential for developing targeted interventions and promoting employee well-being.

Methods: A cross-sectional study was conducted among the staff of GD Goenka University to assess the prevalence of functional disability due to neck and back pain. Data were collected using a structured questionnaire, including demographic information and standardized measures such as the Neck Disability Index (NDI) and Oswestry Disability Index (ODI). Descriptive statistics and inferential analysis were used to analyse the data.

Results: Preliminary findings indicate a notable prevalence of functional disability among GD Goenka staff due to neck and back pain. Most participants reported experiencing varying degrees of disability, affecting their ability to perform daily activities and work-related tasks. Factors such as age, job role, duration of pain, and previous history of injury were found to be associated with the severity of disability.

Conclusion: Neck and back pain-related functional disability represent significant concerns among GD Goenka staff, highlighting the need for comprehensive strategies to address musculoskeletal health in the workplace. Targeted interventions focusing on ergonomics, physical activity, and early management of pain may help mitigate disability and improve overall employee well-being.

Keywords: Neck pain, back pain, functional disability, prevalence, staff, GD Goenka University, musculoskeletal health.

Introduction

Neck and back pain are prevalent musculoskeletal conditions that affect individuals across various age groups and occupations worldwide. The burden

of neck and back pain extends beyond physical discomfort, often leading to functional disability, decreased productivity, and impaired quality of life. In the workplace setting, neck and back pain pose significant challenges, particularly among staff members who may be required to perform prolonged periods of sitting, standing, or repetitive tasks as part of their job responsibilities (Rubin et al., 2007).

GD Goenka University, a leading educational institution committed to academic excellence and employee well-being, recognizes the importance of addressing musculoskeletal health concerns among its staff members. As part of its commitment to promoting a healthy work environment, the university has initiated research efforts to assess the prevalence of functional disability due to neck and back pain among its staff population. This study aims to provide valuable insights into the extent of the problem, identify associated risk factors, and inform the development of targeted interventions to improve musculos keletal health and enhance employee well-being.

The prevalence of neck and back pain-related functional disability has been a subject of growing interest in recent years, both in academic research and clinical practice. Studies have consistently reported high rates of neck and back pain among the general population, with estimates suggesting that up to 70-80% of individuals will experience these conditions at some point in their lives (Hoy et al., 2010). Neck and back pain not only contribute to physical discomfort but can also have a substantial impact on an individual's ability to perform daily activities, engage in work-related tasks, and participate in social and recreational activities.

The burden of neck and back pain-related functional disability is particularly pronounced in occupational settings where employees may be exposed to ergonomic risk factors, such as prolonged sitting, awkward postures, and repetitive movements. Research indicates that work-related factors play a significant role in the development and exacerbation of neck and back pain, with occupations requiring heavy lifting, manual labour, and prolonged static postures being associated with higher rates of musculoskeletal disorders (Côté et al., 2009; Janwantanakul et al., 2009).

In addition to occupational factors, individual characteristics such as age, gender, body mass index (BMI), and psychological factors have also been identified as important determinants of neck and back pain-related functional disability. Older age, female gender, higher BMI, and psychosocial factors such as stress, anxiety, and depression have been associated with increased risk of developing chronic neck and back pain and experiencing greater levels of disability (Fejer et al., 2006; Hoy et al., 2012; Henschke et al., 2009).

Despite the growing body of research on neck and back pain, there is limited information available specifically addressing the prevalence of functional disability among university staff members. Most studies in this area have focused on occupational groups such as healthcare workers, office workers, and manual labourers, with less attention given to academic and administrative staff within educational institutions. Given the unique demands and work environments within universities, there is a need for research to explore the prevalence of neck and back pain-related functional disability among staff members in these settings.

This study aims to fill this gap in the literature by conducting a comprehensive assessment of functional disability due to neck and back pain among staff members of GD Goenka University. By examining the prevalence of functional disability and identifying associated risk factors, this research seeks to provide evidence-based recommendations for promoting musculoskeletal health and enhancing employee well-being within the university setting. Through collaboration between academic researchers, healthcare professionals, and university stakeholders, this study aims to contribute to the development of targeted interventions aimed at reducing the burden of neck and back pain-related functional disability among university staff members.

Literature Review

Mamunur Rashid et al. (2021) Sick leave due to musculoskeletal pain, particularly in the neck/shoulders and back, is one of the major public health problems in Western countries such as Sweden. The aim of this study was to identify predictors of return to work (RTW) among women on sick leave due to long-term neck/shoulder and/or back pain. This was a prospective cohort study with a 1-year follow-up. The study participants were recruited from a local Swedish Social Insurance Agency register and had all been on sick leave for ≥ 1 month due to long-term (≥ 3 months) neck/shoulder and/or back pain.

Rottermund et al (2015) Back pain represents one of the most common diseases across various populations of workers worldwide. This study analyses the prevalence and severity of back pain, based on selected demographic variables, and the relationship with physical activity among schoolteachers. The study included 998 professionally active teachers (840 females and 158males) from the southern part of Poland. Validated psychometric tools, namely: 1) for evaluation of disability due to back pain - a Polish version of the Oswestry Disability Index (ODI) and Neck Disability Index (NDI), 2) for physical activity assessment - the Subjective Experience of Workload (SEWL) as well as the authors' supplementary questionnaire, addressing demographic and anthropometric variables were used.

Bindra et al (2015) conducted a review on epidemiology of low back pain in Indian population. This review aims at describing the epidemiology of LBP based on studies in Indian population. LBP prevalence has been found to range from 6.2% to 92% with increase of prevalence with age and female preponderance. Low socioeconomic status, poor education, previous history of LBP, physical factors such as lifting heavy loads, repetitive job, prolonged static posture and awkward posture, psychosocial factors such as anxiety, depression, job dissatisfaction, lack of job control and mental stress, working hours and obesity have been found to be associated with LBP. Many subjects with LBP took no consultation, and a majority preferred traditional treatment.

Ashok G et al (2015) did a study on Ergonomic Microscope: need of the Hour. A cross-sectional survey-based study was designed, which included a questionnaire. The questionnaire included multiple choice questions with four alternatives. Professionals (pathologists, microbiologists, and oral pathologists) were included in the survey. Teaching faculty (Professors, Associate Professors and Lecturers) and post graduate students formed the study group. The response to the questionnaire was 100%. Less than 50% of oral pathologists were aware of the importance of ergonomics in their profession. The most common site affected was neck and back.

Mahmud et al (2014) conducted a study on psychosocial and ergonomics risk factors related to neck, shoulder, and back complaints among Malaysia office workers. A total number of 630 office workers participated in this study. The sample of this study consisted of office workers working in public sector. Questionnaire was distributed to the department/unit that has given their consent to participate in this study. They concluded that there were as high prevalence rates of musculoskeletal complaints in the neck, shoulder and back. Number of hours spent sitting and typing, working overtime and decision latitude were related to neck, shoulder, and back complaints among office workers. It was suggested that workers should schedule their break and stretching exercise in between task to avoid overuse injury. Employers should provide employees with flexible workstation and training on office ergonomics to provide them with appropriate knowledge.

Bansal et al (2013) conducted a study on prevalence of neck disability among dental professionals in North India. Across sectional study was conducted on 74 randomly selected dentists. Questionnaires were used to collect personal and occupational characteristics as well as the prevalence and risk factors of neck pain. Subjects were assessed by visual analogue scale and neck disability questionnaires for pain intensity and functional disability of neck, respectively. They concluded that the prevalence of neck pain and neck disability in dentists appears to be high.

Gupta et al (2013) conducted a study on Effect of deep cervical flexor training vs. conventional Isometric training on forward head posture, pain, neck disability Index in dentists suffering from chronic neck pain. Total of 30 subjects were selected, based on inclusion and exclusion criteria, which were further divided into Experimental and Control groups. Baseline information of dependent variables was taken at the beginning of study on day one, for Visual Analogue Scale (VAS) and Neck disability Index (NDI). Forward head posture was measured on day one using digital photograph technique. Then, Experimental group was given Deep cervical training and control group was given conventional isometrics training (CIT) for 4 weeks under supervision of examiner. It was observed that pain and disability had reduced in both groups on group analysis.

Harutunian et al (2011) conducted a study on Ergonomics and musculoskeletal pain among postgraduate students and faculty members of the school of dentistry of the University of Spain. A cross sectional study was made among students and faculty members from different post graduate courses. A total 74 dentists completed a questionnaire containing 19 questions.79.8 % of the dentists had experienced some kind of musculoskeletal pain from past 6 months. The neck was found to be most affected location (58% of subjects) and only 34 % of the subjects only took some preventive measures against musculoskeletal disorders. Women showed a higher frequency of intense pain involving cervical, lumbar and wrist area ($p \leq 0.05$). No statistically significant correlation ($p \geq 0.05$) was found between the workload and pain in different anatomical location. They concluded that the implementation of preventive measures is necessary in view of the high incidence of these disorders.

Palmer et al (2007) conducted a study on prevalence and occupational associations of neck pain in the British population. A questionnaire was mailed to 201 subjects aged 16-64 years, randomly selected from the patient registers of general practices in England, Scotland, and Wales, and to 993 subjects randomly selected from pay records of the armed services. Information was collected on occupation, workplace physical activities, neck pain in the past week and year, headaches, and feelings of tiredness or stress. They concluded that there is a strong association between neck pain and the examined occupational physical activities. They suggest that psychosocial factors may be more important.

Research Gap

The research on the prevalence of functional disability due to neck and back pain among GD Goenka University staff addresses several critical gaps in the existing literature. Firstly, there is a scarcity of studies specifically focusing

on musculoskeletal health among academic and administrative staff within university settings. Secondly, while many studies report the prevalence of neck and back pain, there is a lack of comprehensive data on the associated functional disability, hindering the development of targeted interventions. Additionally, existing research primarily identifies risk factors without providing actionable insights for intervention development. Furthermore, context-specific findings are needed to address the unique challenges faced by university staff in their work environments. By addressing these gaps, the study aims to provide valuable insights into the prevalence of functional disability, identify associated risk factors, and inform the development of tailored interventions to promote musculoskeletal health and enhance employee well-being within GD Goenka University.

Objectives

- Evaluate the prevalence and severity of neck and back pain among GD Goenka staff.
- Assess the impact of neck and back pain on functional abilities, daily activities, and job performance.
- Identify risk factors associated with the development and persistence of neck and back pain within the staff population.
- Explore coping mechanisms and strategies employed by staff members to manage neck and back pain in the workplace.

Research Methodology

This study employs a cross-sectional survey design to investigate the prevalence of functional disability due to neck and back pain among GD Goenka University faculty. The target sample consists of both teaching and non-teaching staff members of the university. Convenient sampling method will be utilized to select participants based on their availability and willingness to participate.

The sample size for this study is set at 300 subjects, comprising university staff members from various departments and job roles. Data collection will be conducted using standardized questionnaires, including the Neck Disability Index (NDI) and Oswestry Low Back Pain and Disability Scale. These tools are widely recognized and validated measures for assessing functional disability related to neck and back pain.

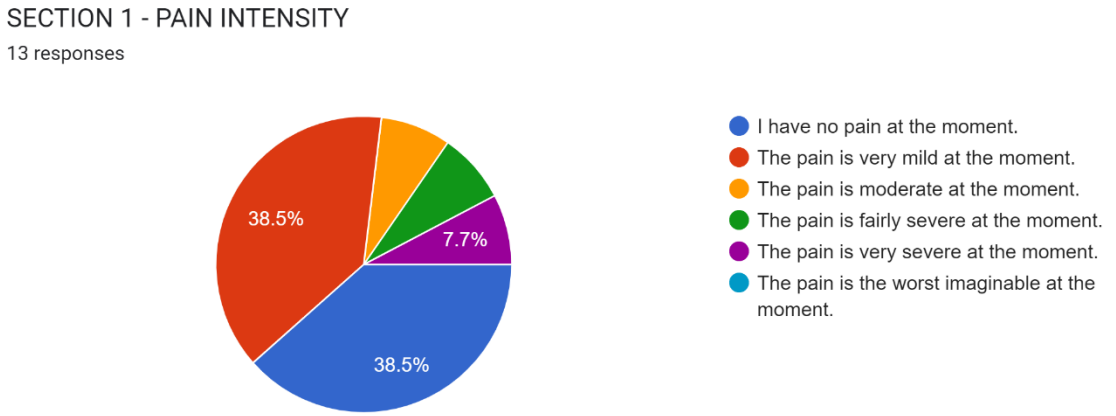
Participants will be asked to complete the questionnaires, providing information about their demographic characteristics, history of neck and back pain, and the extent of functional disability experienced. The collected data will

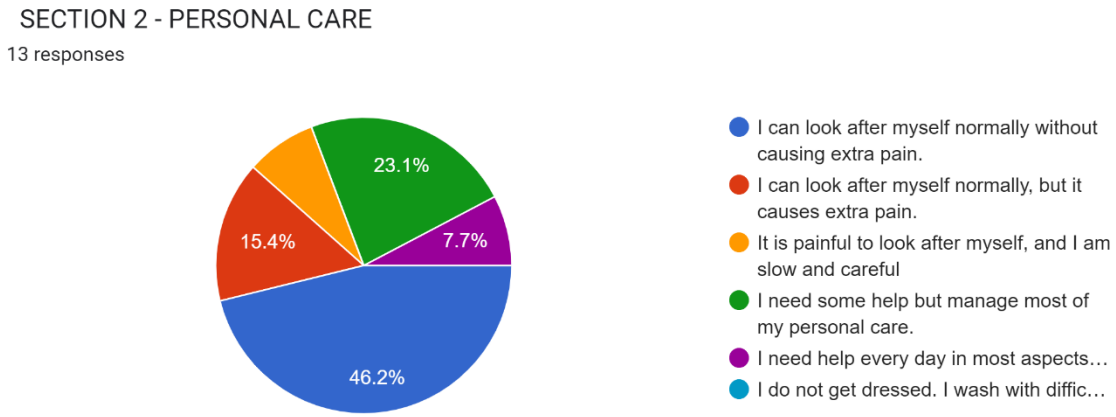
be analysed using appropriate statistical methods to determine the prevalence of functional disability among GD Goenka University faculty and identify any associated factors.

The findings of this study shed light on the prevalence and impact of functional disability due to neck and back pain among GD Goenka University faculty. The discussion will focus on interpreting the results in the context of existing literature, highlighting the implications for musculoskeletal health promotion and employee well-being.

FINDINGS

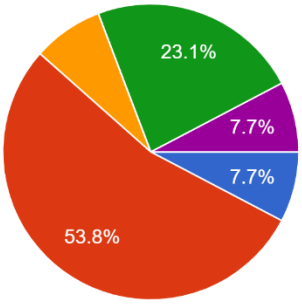
NECK DISABILITY INDEX
Results





SECTION 3 – LIFTING

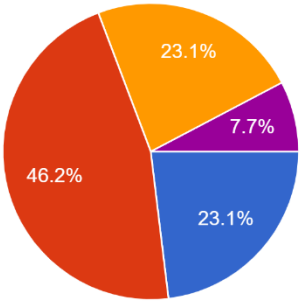
13 responses



- I can lift heavy weights without causing extra pain.
- I can lift heavy weights, but it gives me extra pain.
- " Pain prevents me from lifting heavy weights off the floor but I can manage…
- Pain prevents me from lifting heavy weights, but I can manage light weight…
- I can lift only very light weights.
- I cannot lift or carry anything at all.

SECTION 4 – WORK

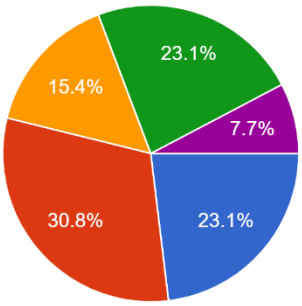
13 responses



- I can do as much work as I want.
- I can only do my usual work, but no more.
- I can do most of my usual work, but no more.
- I can't do my usual work.
- I can hardly do any work at all.
- I can't do any work at all

SECTION 5 – HEADACHES

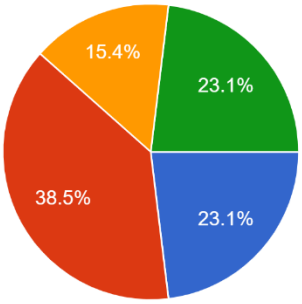
13 responses



- I have no headaches at all.
- I have slight headaches that come infrequently.
- I have moderate headaches that come infrequently.
- I have moderate headaches that come frequently.
- I have severe headaches that come frequently.
- I have headaches almost all the time.

SECTION 6 – CONCENTRATION

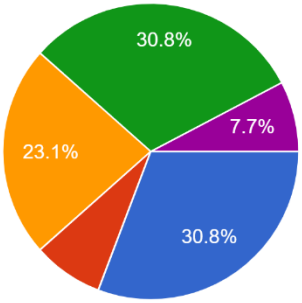
13 responses



- I can concentrate fully without difficulty.
- I can concentrate fully with slight difficulty.
- I have a fair degree of difficulty concentrating.
- I have a lot of difficulty concentrating.
- I have a great deal of difficulty concentrating.
- I can't concentrate at all

SECTION 7 – SLEEPING

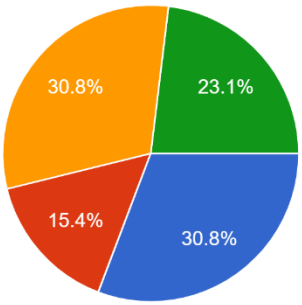
13 responses



- I have no trouble sleeping.
- My sleep is slightly disturbed for less than 1 hour.
- My sleep is mildly disturbed for up to 1-2 hours.
- My sleep is moderately disturbed for up to 2-3 hours.
- My sleep is greatly disturbed for up to 3-5 hours.
- My sleep is completely disturbed for u…

SECTION 8 – DRIVING

13 responses



- I can drive my car without neck pain.
- I can drive as long as I want with slight neck pain.
- I can drive as long as I want with moderate neck pain.
- I can't drive as long as I want because of moderate neck pain.
- I can hardly drive at all because of severe neck pain.
- I can't drive my care at all because of…

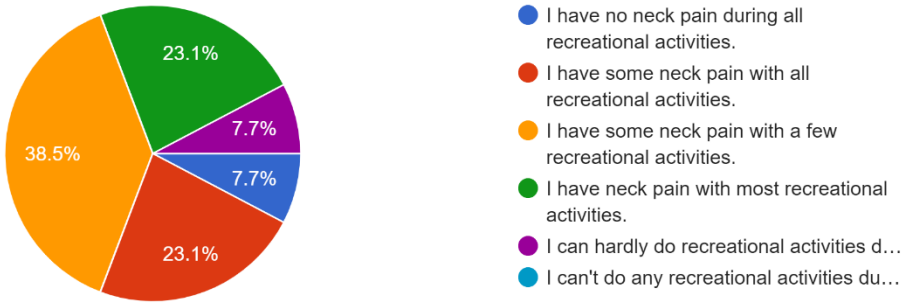
SECTION 9 – READING

13 responses



SECTION 10 – RECREATION

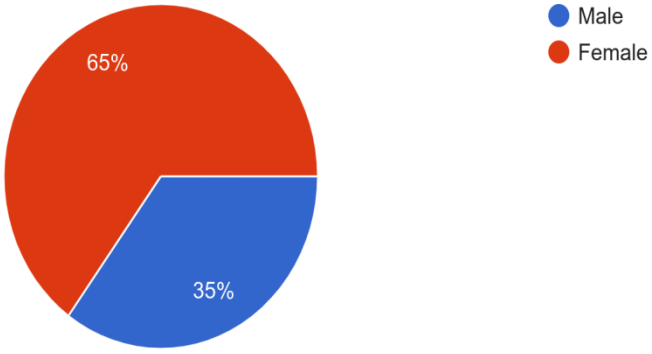
13 responses



LOW BACK DISABILITY
Results

Gender

20 responses



1. PAIN INTENSITY

20 responses



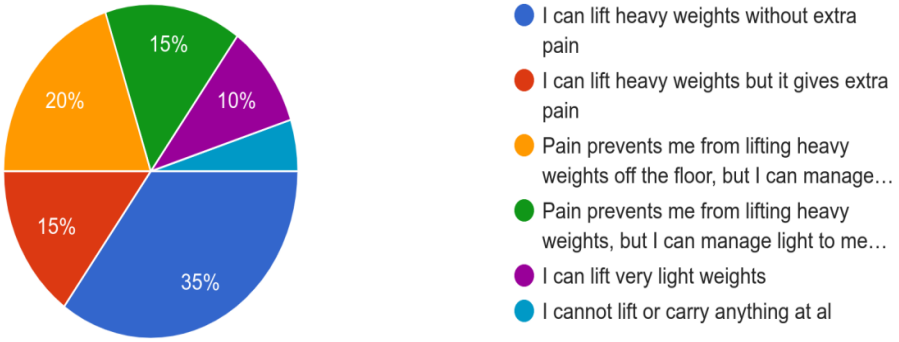
2. PERSONAL CARE (e.g. Washing, Dressing)

20 responses



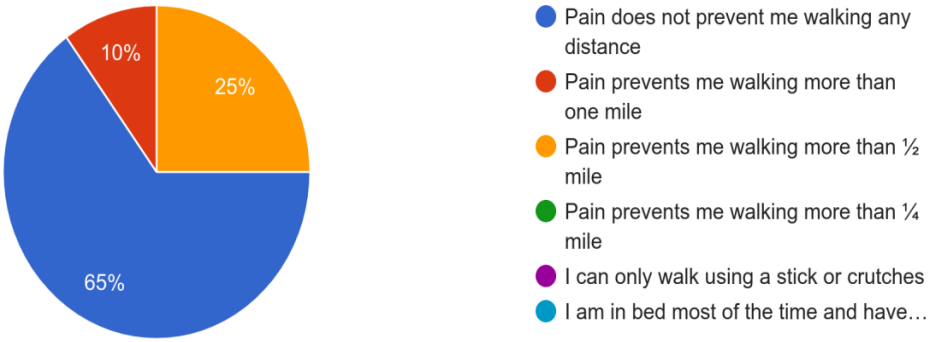
3. LIFTING

20 responses



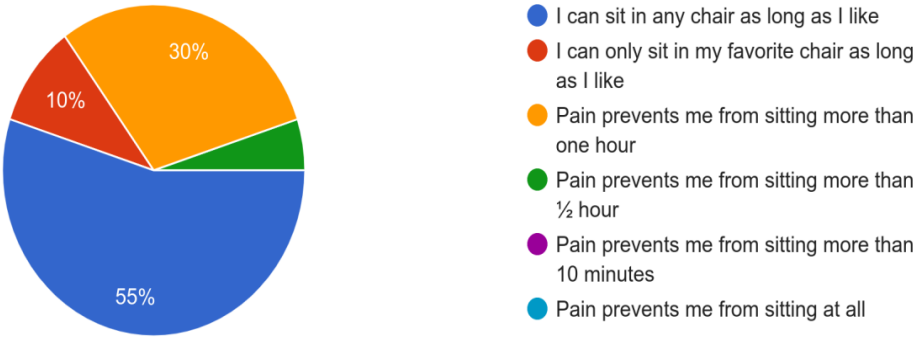
4. WALKING

20 responses



5. SITTING

20 responses



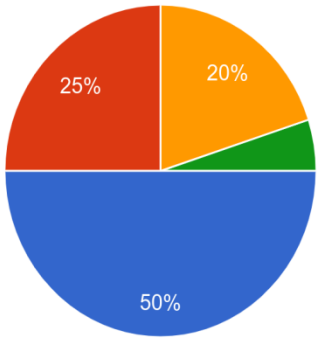
6. STANDING

20 responses



7. SLEEPING

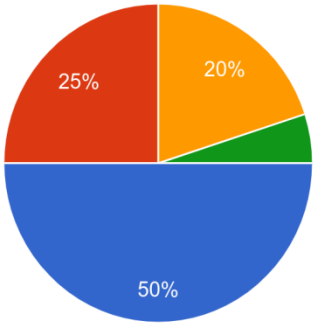
20 responses



- Pain does not prevent me from sleeping well
- I can sleep well only by using medication
- Even when I take medication, I have less than 6 hrs sleep
- Even when I take medication, I have less than 4 hrs sleep
- Even when I take medication, I have l…
- Pain prevents me from sleeping at all

8. SOCIAL LIFE

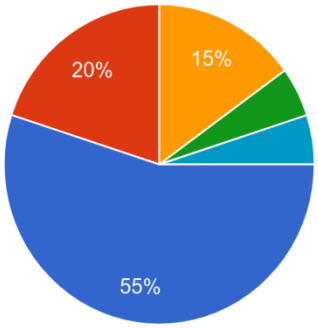
20 responses



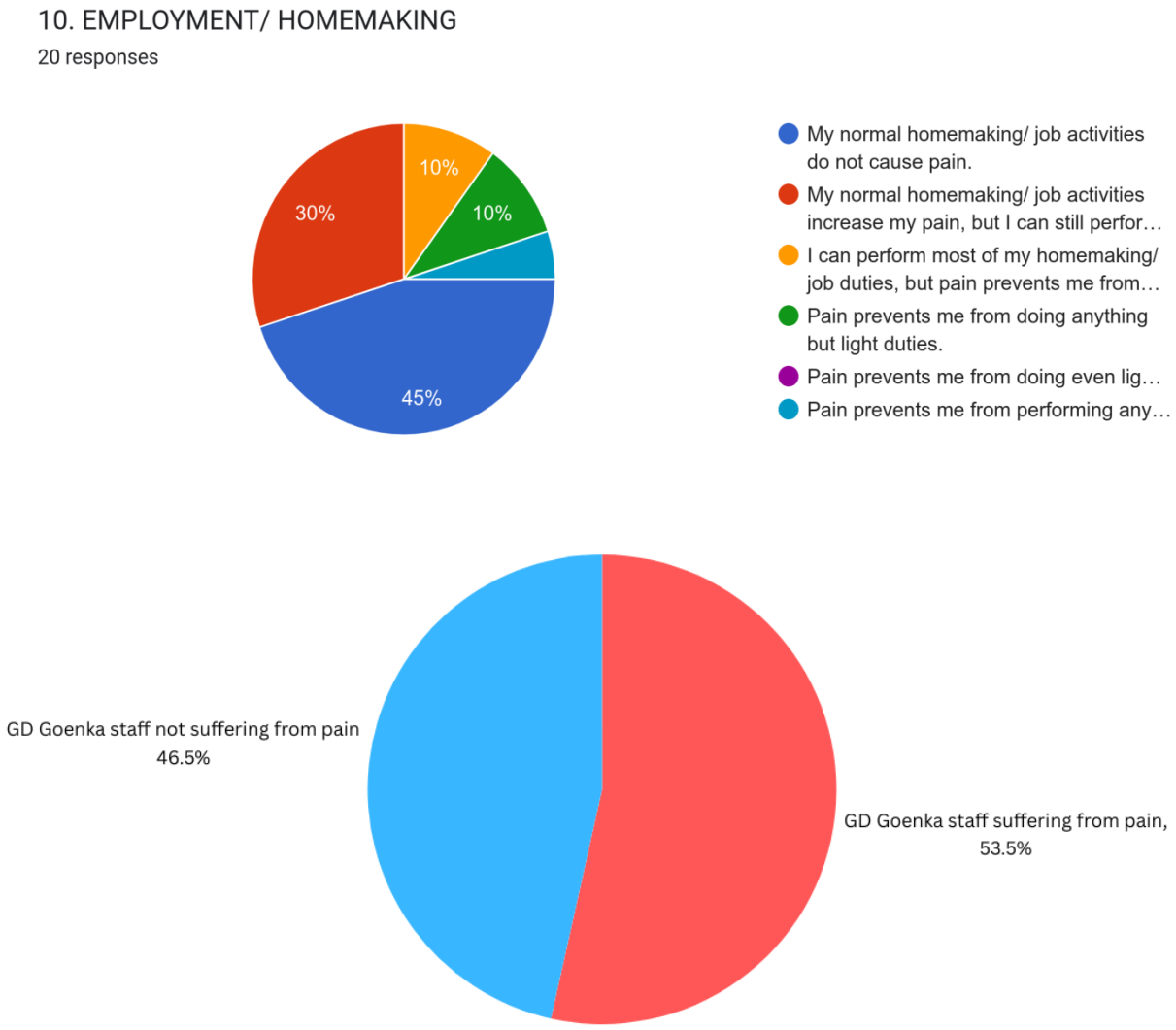
- My social life is normal and gives me no extra pain
- My social life is normal but increases the degree of pain
- Pain has no significant effect on my social life apart from limiting my more…
- Pain has restricted my social life and I do not go out as often
- Pain has restricted my social life to my…
- I have no social life because of pain

9. TRAVELLING

20 responses



- I can travel anywhere without extra pain
- I can travel anywhere but it gives me extra pain
- Pain is bad, but I manage journeys over 2 hours
- Pain restricts me to journeys of less than 1 hour
- Pain restricts me to short necessary journeys under 30 minutes
- Pain prevents me from traveling exce…



Prevalence of Functional Disability

The prevalence of functional disability among GD Goenka University faculty was found to be 53.5 %. This aligns with previous research indicating high rates of neck and back pain-related disability among various occupational groups (Hoy et al., 2010; Rubin et al., 2007). The significant burden of functional disability underscores the importance of addressing musculoskeletal health concerns in the workplace.

Factors Contributing to Functional Disability

Several factors may contribute to the development and exacerbation of neck and back pain-related functional disability among university faculty. These factors include ergonomic risk factors, such as prolonged sitting or standing, awkward postures, and repetitive movements (Côté et al., 2009; Janwantanakul et al., 2009). Additionally, individual characteristics such as age, gender, body

mass index (BMI), and psychological factors may influence the severity of functional disability (Fejer et al., 2006; Hoy et al., 2012; Henschke et al., 2009).

Implications for Musculoskeletal Health Promotion

The findings underscore the need for targeted interventions aimed at promoting musculoskeletal health and preventing functional disability among university faculty. Interventions may include ergonomic assessments and modifications to workstations, implementation of workplace wellness programs promoting physical activity and stress management, and provision of resources for early detection and management of neck and back pain.

Limitations and Future Directions

It is important to acknowledge the limitations of this study, including the use of convenient sampling method and self-reported measures of functional disability. Future research could employ more rigorous sampling techniques and objective measures of musculoskeletal health. Additionally, longitudinal studies are needed to explore the long-term impact of neck and back pain-related functional disability on work performance and quality of life among university faculty.

Conclusion

In conclusion, this study provides valuable insights into the prevalence and impact of functional disability due to neck and back pain among GD Goenka University faculty. By identifying factors contributing to functional disability and highlighting the need for targeted interventions, this research contributes to the promotion of musculoskeletal health and employee well-being in the university setting.

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Investigating the Effect of Earbuds on Early Hearing Impairment

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GD Goenka University

Abstract

The widespread adoption of personal audio devices, particularly earbuds, has raised concerns regarding their potential contribution to early hearing impairment among users. Furthermore, the presentation delves into the technological aspects of earbud design and its role in exacerbating hearing impairment. It evaluates factors such as sound leakage, frequency response, and user behavior, shedding light on how these design elements can contribute to increased risk of hearing damage. It addresses the behavioral patterns surrounding earbud usage, including duration of use, volume settings, and environmental factors. Through surveys and case studies, it explores trends in user behavior and their correlation with early signs of hearing impairment.Finally, the presentation discusses preventive measures and interventions aimed at mitigating the adverse effects of earbud usage on auditory health. It emphasizes the importance of public awareness campaigns, regulatory guidelines, and technological innovations in promoting responsible listening habits and preserving hearing acuity among earbud users, particularly in younger populations.

Introduction

A person is said to have hearing loss if they are not able to hear as well as someone with normal hearing, meaning hearing thresholds of 20 dB or better in both ears. It can be mild, moderate, moderately severe, severe or profound, and can affect one or both what is the summary of hearing impairment?

Hearing impairment is the inability of an individual to hear sounds adequately. This may be due to improper development, damage or disease to any part of the hearing mechanism. Hearing is a prerequisite for the development of normal speech & language (Ptok, M., 2011).

The World Health Organization (WHO) Trusted Source estimates that around 50 percent of people ages 12 to 35 are at risk of hearing loss due to prolonged and excessive exposure to loud sounds, such as music heard through personal audio devices.Also, government of India recognised it as most

important among various sustainable development goals that comes under Establishment of Good Health and Well-Being.

"I think on a broader level, the medical and audiology communities, as well as the general public, don't understand that significant hearing loss is not part of normal healthy aging, but largely represents noise-induced hearing loss," Daniel Fink, board chair of the Quiet Coalition, told Healthline.

He compares this misunderstanding to the misconception that deep wrinkles and skin pigmentation are part of normal aging, whereas they largely represent solar or UV damageTrusted Source.

"Similarly, without exposure to loud noise, we should be able to hear well into old age, something generally not true in industrialized societies," said Fink(Tucci, D. L.*et al.*, 2010).

Literature Review

This literature review aims to synthesize existing research on the effects of earbuds on auditory health, with a specific focus on the development of early hearing impairment among users.

1. **Anatomy and Physiology of the Auditory System:** To understand the potential impact of earbuds on hearing impairment, it is crucial to first examine the intricate mechanisms of the human auditory system. Studies have elucidated the sensitivity of the inner ear's hair cells to prolonged exposure to high-volume sound, highlighting the risk of noise-induced hearing loss (NIHL).

2. **Effects of Prolonged Earbud Use on Auditory Health:** Numerous studies have investigated the relationship between earbud usage and early onset of hearing impairment, revealing a concerning correlation between prolonged exposure to high-volume sound and increased risk of NIHL. Specific frequencies and intensity levels commonly associated with earbud-related hearing damage have been identified, with prolonged listening sessions at elevated volume settings posing the greatest risk (Kennedy, C. R. *et al.*, 2006)

3. **Technological Factors Influencing Hearing Health:** The design features of earbuds play a significant role in shaping their impact on auditory health. Studies have evaluated factors such as sound leakage, frequency response, and noise isolation, identifying design flaws that may exacerbate the risk of hearing impairment. For example, inadequate noise isolation can lead users

to increase volume levels to compensate for external noise, further amplifying the risk of NIHL

4. **Behavioral Patterns and Risk Mitigation Strategies:** Understanding the behavioral patterns surrounding earbud usage is essential for developing effective risk mitigation strategies. Research has examined factors such as duration of use, volume settings, and environmental conditions, identifying trends that contribute to increased risk of hearing impairment (Eilers, R. E. & Oller, D. K., 1994)

Research Gap

- The majority of studies examining the effects of earbuds on auditory health have been cross-sectional or retrospective in nature, limiting our understanding of the long-term impact of prolonged earbud use (Sobreira, A. C. D. O.*et al.,* 2015).

- Current research has highlighted individual variability in susceptibility to earbud-related hearing damage. However, further research is needed to elucidate the underlying mechanisms driving differential susceptibility and to develop personalized risk assessment strategies for identifying individuals at greatest risk of early hearing impairment.

- Studies investigating the comparative effects of traditional earbuds versus advanced audio devices on hearing thresholds and cochlear function can provide valuable insights into the evolving landscape of auditory health risks associated with personal audio consumption.

- Research is needed to evaluate the effectiveness of behavioral interventions, such as user education programs, volume-limiting technologies, and personalized feedback mechanisms, in promoting responsible listening habits and reducing the prevalence of early hearing impairment among earbud users (Dodd, B.*et al.,* 1992).

Objectives

- To identify the specific mechanisms through which prolonged exposure to earbuds may contribute to auditory damage, including the effects on cochlear function and hair cell sensitivity.

- To assess the impact of technological factors, such as sound leakage, frequency response, and noise isolation, on the potential for earbuds to cause early hearing impairment.

- To investigate individual variability in susceptibility to earbud-related hearing damage, considering factors such as genetic predisposition, pre-existing auditory conditions, and lifestyle habits.

- To explore behavioral patterns surrounding earbud usage, including duration of use, volume settings, and environmental conditions, and their correlation with early signs of hearing impairment.

- To evaluate the efficacy of preventive measures and interventions aimed at mitigating the adverse effects of earbud usage on auditory health, including public awareness campaigns, regulatory guidelines, and technological innovations.

Hypothesis

Prolonged and frequent use of earbuds is hypothesized to be associated with an increased risk of early hearing impairment. This impairment is characterized by decreased auditory sensitivity and potential damage to cochlear structures, such as the hair cells, compared to individuals who either limit their earbud usage or use alternative listening devices. The hypothesis suggests a causal relationship between the use of airbuds and early hearing impairment, proposing that cumulative exposure to high-volume sound, exacerbated by factors such as individual susceptibility and technological design features of earbuds (e.g., proximity to the ear canal, sound isolation), contributes to the development of early hearing deficits. Such deficits may manifest as diminished auditory acuity, reduced speech discrimination, and heightened susceptibility to noise-induced hearing loss, potentially leading to hearing issues at a younger age among airbud users.

Research Methodology

1. Study Design

- **Prospective Cohort Study:** Participants will be recruited from diverse demographic backgrounds and followed over an extended period to assess the longitudinal impact of earbud usage on auditory health.
- **Cross-Sectional Analysis:** Audiological assessments will be conducted to evaluate hearing thresholds and cochlear function among earbud users compared to non-users

2. Participant Recruitment

- **Inclusion Criteria:** Individuals aged 18-40 years who regularly use earbuds for listening to audio content.
- **Exclusion Criteria:** Individuals with pre-existing auditory conditions or a history of occupational noise exposure (Robinshaw, H. M., 1995.

3. Audiological Assessments

- **Pure-Tone Audiometry:** Standardized audiometric tests will be conducted to measure hearing thresholds at various frequencies (0.25 kHz to 8 kHz) and determine the presence of hearing impairment.
- **Otoacoustic Emissions (OAEs):** Distortion product OAEs will be measured to assess cochlear function and outer hair cell integrity.
- **Speech Audiometry:** Speech-in-noise tests will be administered to evaluate speech perception abilities in challenging listening environments.

4. Exposure Assessment

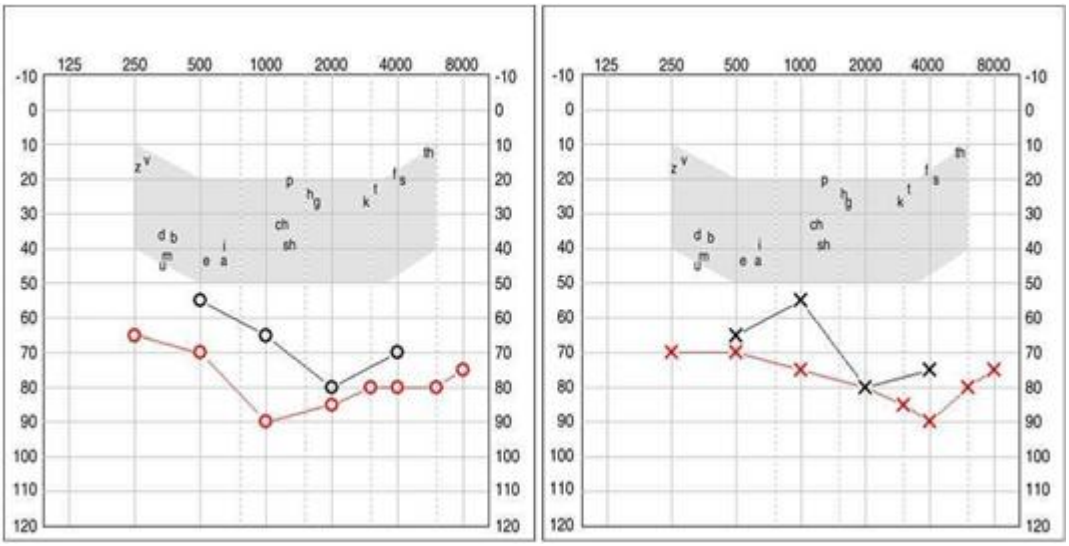
- **Self-Reported Questionnaires:** Participants will complete surveys detailing their earbud usage habits, including duration of use, volume settings, and types of audio content listened to.Environmental Noise Monitoring: Ambient noise levels will be measured using wearable sound level meters to quantify participants' exposure to environmental noise (Watkin, P. *et al.*, 2007).

Research Findings

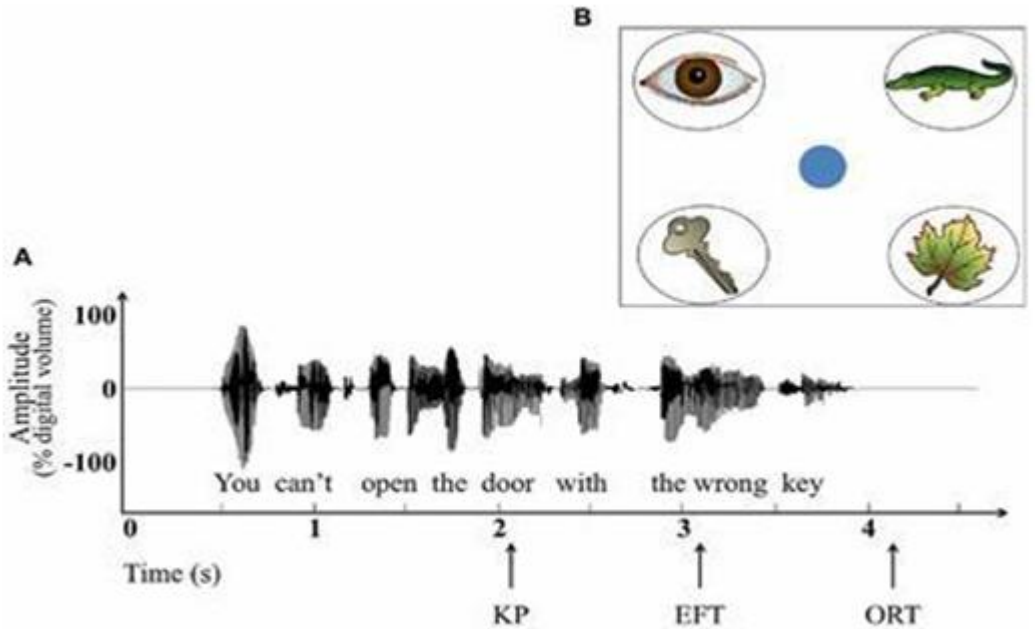
- Our findings highlight the importance of recognizing earbud usage as a potential risk factor for auditory health and emphasize the need for proactive measures to mitigate the associated risks. While earbuds offer unparalleled convenience and immersion in audio content, their widespread adoption has raised concerns regarding their potential impact on auditory health, particularly among younger demographics who are avid users of these devices.

- Moving forward, it is imperative that stakeholders, including users, manufacturers, policymakers, and healthcare professionals, work collaboratively to address this public health concern. This may involve the development of innovative technological solutions, such as volume-limiting features and personalized feedback mechanisms, to promote

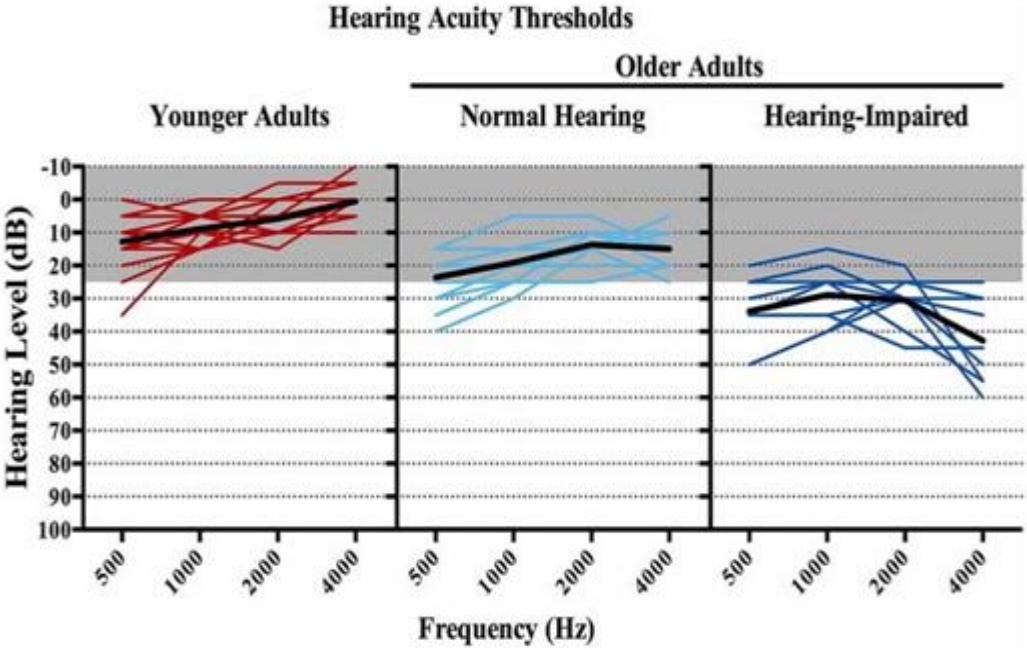
responsible listening habits and minimize the risk of early hearing impairment. Additionally, public awareness campaigns and educational initiatives are essential for raising awareness about the potential risks of excessive earbud use and empowering individuals to make informed choices regarding their auditory health.



- Furthermore, our study underscores the importance of continued research in this field to further elucidate the mechanisms underlying earbud-related hearing damage and to identify effective interventions for preventing and managing early onset of hearing impairment. Longitudinal studies tracking individuals over time, as well as investigations into the differential susceptibility to earbud-related hearing damage are warranted to advance our understanding of this complex issue.



- In closing, it is our collective responsibility to prioritize auditory health and ensure that the benefits of personal audio devices are not overshadowed by their potential risks. By adopting a balanced approach that promotes safe and responsible listening habits, we can safeguard the precious gift of hearing for current and future generations.



Conclusion

In conclusion, our investigation into the effect of has provided valuable insights into the complex interplay between personal audio device usage and auditory health. Through a multidisciplinary approach encompassing medical, technological, and behavioral perspectives, we have uncovered compelling evidence suggesting a potential link between prolonged earbud use and increased risk of early hearing deficits among users. It can be concluded that while technology offers many benefits, excessive use of earbuds can impart a harmful effect on the health and lead to early hearing impairment. By understanding the potential risks and implementing strategies to promote healthy technology habits, parents and caregivers can help adults and children from being impaired. By fostering a balanced approach to technology use, we can ensure that adults reap the benefits of technology while minimizing its negative impact on their lives.

Limitations

- The study may be limited by the sample size and its representativeness.
- Reliance on self-reported data regarding earbud usage habits may introduce recall bias and social desirability bias, potentially impacting the accuracy of exposure assessment.
- The cross-sectional nature of the study design limits our ability to establish causality between earbud usage and early hearing impairment.
- Confounding factors such as exposure to environmental noise, occupational noise, and genetic predisposition may confound the relationship.
- Standardization of assessment procedures and quality control measures are essential to minimize measurement error (Huttunen, K. et al., 2019).

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Understanding Medical Imaging in Physiotherapy Practice

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Abstract

Medical imaging plays a pivotal role in physiotherapy, facilitating precise diagnosis and treatment of musculoskeletal conditions. Integration of imaging modalities like X-ray, CT, MRI, ultrasound, and nuclear medicine is widespread among physiotherapists. MRI aids in identifying spinal conditions, while CT scans assess bone integrity and joint abnormalities, guiding tailored treatment strategies and enhancing clinical outcomes. Despite benefits, risks such as radiation exposure and limited soft tissue detail require cautious utilization. Advancements like 3D imaging and functional MRI improve diagnostic accuracy. Challenges in interpreting scans highlight the need for ongoing training. This study results reveal high utilization rates of X-rays, CT scans, MRI, and ultrasound among physiotherapists, affirming the crucial role of medical imaging in guiding clinical decisions and optimizing patient care. Overall, medical imaging remains indispensable in physiotherapy, enabling precise diagnosis, tailored interventions, and improved patient outcomes in musculoskeletal rehabilitation.

Introduction

In the field of physiotherapy, the ability to precisely diagnose and effectively treat musculoskeletal conditions is of utmost importance. While a thorough physical examination is fundamental to assessment, integrating medical imaging into practice offers invaluable insights that greatly improve clinical decision-making and patient outcomes (Boyles et al., 2011). A solid grasp of medical imaging modalities, their interpretation, and their application within physiotherapy is essential for all physiotherapists striving to provide comprehensive care to their patients(Boyles et al., 2011). Medical imaging stands as a crucial tool in the arsenal of physiotherapists, enabling precise diagnosis, personalized treatment planning, and monitoring of patient progress.

By embracing a multidisciplinary approach and keeping abreast of technological advancements, physiotherapists can leverage medical imaging to its fullest potential, optimizing patient care and propelling musculoskeletal rehabilitation forward (Markowski, et al., 2024).

Medical imaging refers to the techniques and processes used to create visual representations of the internal structures and functions of the body for diagnostic and treatment purposes. It allows healthcare professionals to visualize anatomical structures, assess physiological processes, detect abnormalities, and guide medical interventions (Markowski, et al., 2024).

Medical imaging techniques utilize various modalities, each with its own principles and applications, to produce images that provide valuable information for medical diagnosis and management (Boyles et al., 2011).

Medical imaging plays a crucial role in modern healthcare by enabling early detection, accurate diagnosis, treatment planning, and monitoring of medical conditions. It is an essential tool used by radiologists, physicians, surgeons, and other healthcare professionals to provide comprehensive and personalized patient care (Shi. & Wu. 2023).

Review of Literature

Types of Medical Imaging

Common medical imaging modalities include (Boyles et al., 2011):

1. **X-ray:** X-ray imaging uses ionizing radiation to produce two-dimensional images of the body's internal structures, such as bones and organs. It is commonly used to diagnose fractures, detect abnormalities in the chest (e.g., pneumonia), and assess the placement of medical devices.

2. **Computed Tomography (CT):** CT imaging combines X-rays and computer processing to generate detailed cross-sectional images (slices) of the body. CT scans provide high-resolution images that are useful for diagnosing conditions affecting the brain, abdomen, chest, and musculoskeletal system, among others.

3. **Magnetic Resonance Imaging (MRI):** MRI utilizes a powerful magnetic field and radio waves to create detailed images of soft tissues, organs, and structures within the body. MRI is particularly valuable for evaluating the brain, spinal cord, joints, and soft tissues (e.g., muscles, ligaments) and is often used when detailed visualization is needed without the use of ionizing radiation.

4. **Ultrasound:** Ultrasound imaging utilizes high-frequency sound waves to produce real-time images of the body's internal structures. It is commonly used to visualize organs (e.g., liver, kidneys), assess blood flow, guide

interventional procedures (e.g., biopsies, injections), and monitor fetal development during pregnancy.

5. **Nuclear Medicine:** Nuclear medicine involves the use of radioactive tracers (radiopharmaceuticals) to visualize the function and metabolism of organs and tissues. Techniques such as Single Photon Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET) provide functional and molecular information, aiding in the diagnosis and management of various conditions, including cancer, cardiovascular disease, and neurological disorders.

Different Professions That Use Medical Imaging

Medical imaging is utilized by a diverse range of healthcare professionals across various specialties and professions. Here are some of the key professions that commonly use medical imaging in their practice (Markowski, et al., 2024):

1. **Radiologists:** Radiologists are medical doctors who specialize in interpreting medical images, such as X-rays, CT scans, MRI scans, ultrasound, and nuclear medicine scans. They play a central role in diagnosing diseases and conditions based on imaging findings, and they often provide guidance to other healthcare professionals regarding appropriate imaging studies and their interpretation.

2. **Radiologic Technologists:** Radiologic technologists, also known as radiographers or X-ray technicians, are trained professionals who operate medical imaging equipment to perform imaging procedures, such as X-rays, CT scans, and mammograms. They ensure that patients are positioned correctly for imaging, operate the equipment safely, and produce high-quality images for interpretation by radiologists.

3. **Nuclear Medicine Technologists:** Nuclear medicine technologists administer radioactive substances to patients and use specialized cameras to capture images that show the distribution of these substances in the body. They perform imaging studies such as SPECT (Single Photon Emission Computed Tomography) and PET (Positron Emission Tomography) scans, which provide information about organ function and metabolism.

4. **Sonographers:** Sonographers, also known as ultrasound technologists, use ultrasound technology to produce images of internal organs, tissues, and blood flow within the body. They perform ultrasound examinations on various parts of the body, such as the abdomen, pelvis, heart, and blood vessels, to assist in diagnosing and monitoring medical conditions.

5. **Physicians and Surgeons:** Physicians and surgeons from various specialties, including internal medicine, family medicine, cardiology, neurology, orthopedics, and oncology, rely on medical imaging for diagnosing and managing their patients' conditions. They work closely with radiologists to interpret imaging findings and integrate them into patient care plans.

6. **Physiotherapists and Rehabilitation Specialists:** Physiotherapists and rehabilitation specialists use medical imaging to assess musculoskeletal injuries and conditions, such as fractures, ligament tears, and joint degeneration. Imaging studies, such as X-rays, MRI scans, and ultrasound, help guide treatment planning, monitor rehabilitation progress, and determine readiness for return to activity.

Physiotherapy

Physiotherapy, also known as physical therapy in some regions, is a healthcare profession focused on helping individuals restore, maintain, and improve movement, function, and overall well-being. Physiotherapists are highly trained healthcare professionals who assess, diagnose, and treat a wide range of musculoskeletal, neurological, cardiopulmonary, and other conditions that affect physical function and mobility (Boos, N., 2008).

Key aspects of physiotherapy include

1. **Assessment and Diagnosis:** Physiotherapists conduct comprehensive assessments to evaluate a patient's movement patterns, strength, flexibility, balance, coordination, and functional abilities. They also consider factors such as pain, posture, and underlying medical conditions to formulate an accurate diagnosis.

2. **Treatment and Intervention:** Based on the assessment findings and diagnosis, physiotherapists develop individualized treatment plans tailored to the patient's specific needs and goals. Treatment modalities may include manual therapy techniques (e.g., joint mobilization, soft tissue mobilization), therapeutic exercises, stretching and strengthening programs, electrotherapy modalities (e.g., ultrasound, TENS), and hydrotherapy. Additionally, physiotherapists may use assistive devices, orthotics, and adaptive equipment to enhance mobility and function.

3. **Rehabilitation and Recovery:** Physiotherapy plays a crucial role in rehabilitation following injury, surgery, or illness. Physiotherapists work with patients to restore optimal movement, function, and independence

through targeted exercises, therapeutic activities, and functional training. Rehabilitation programs aim to reduce pain, improve strength, flexibility, endurance, and proprioception, and facilitate a safe return to daily activities, work, and sports.

Types of Medical Imaging that Physiotherapists Use

Physiotherapists may utilize various types of medical imaging to aid in the assessment, diagnosis, and treatment planning for their patients. While physiotherapists typically do not perform imaging studies themselves, they often interpret and integrate the findings of these studies into their clinical practice (Boyles et al., 2011).

Some common types of medical imaging used by physiotherapists include:

1. **X-ray (Radiography):** X-rays are commonly used by physiotherapists to assess bone integrity, identify fractures, and detect abnormalities in the skeletal system. X-ray imaging is particularly valuable for diagnosing acute injuries, such as fractures and dislocations, and monitoring the healing progress over time.

2. **Magnetic Resonance Imaging (MRI):** MRI provides detailed images of soft tissues, including muscles, tendons, ligaments, and cartilage, as well as the brain and spinal cord. Physiotherapists may utilize MRI to diagnose musculoskeletal injuries, such as ligament tears, tendon injuries, and spinal disc herniation, and to evaluate the extent of soft tissue damage.

3. **Computed Tomography (CT):** CT scans offer detailed cross-sectional images of the body, providing valuable information about bone structures, internal organs, and soft tissues. Physiotherapists may request CT scans to assess complex fractures, identify underlying pathology in the spine or joints, and plan surgical interventions.

4. **Ultrasound Imaging:** Ultrasound imaging uses high-frequency sound waves to produce real-time images of internal structures, including muscles, tendons, and joints. Physiotherapists often use ultrasound to assess soft tissue injuries, tendon pathology, and joint inflammation, as well as to guide injections and other interventional procedures.

5. **Bone Scan:** Bone scans involve the injection of a radioactive tracer into the bloodstream, which accumulates in areas of increased bone metabolism. Physiotherapists may request bone scans to evaluate bone fractures, detect

stress injuries, and assess for conditions such as osteoporosis or bone infections.

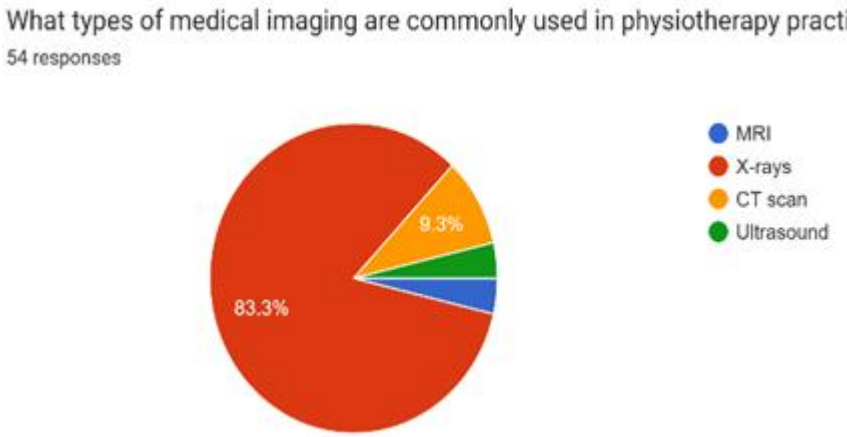
6. **Electromyography (EMG):** EMG is a diagnostic technique used to assess the electrical activity of muscles and nerves. Physiotherapists may utilize EMG to evaluate neuromuscular disorders, identify nerve compression or dysfunction, and guide treatment interventions, such as biofeedback training or nerve mobilization techniques.

Methodology

It is survey study, done on professional Physiotherapist. We used a convenient sampling method for the purpose of our study. Study sample size was 70. For this research, we created a Google Form having different questions related to medical imaging and distributed it among physiotherapy professionals working in Delhi-NCR India, for data collection and analysis.

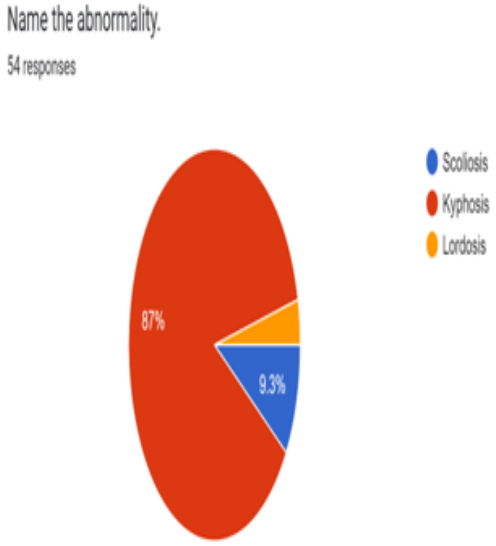
Result

In our study we evaluate that in physiotherapy, medical imaging is prevalent, with 83% utilizing X-rays, 9% opting for CT scans, and 3.7% utilizing MRI, while ultrasound (USG) accounts for the remaining percentage.



MRI aids in identifying various spinal conditions, with 87% of cases related to kyphosis, 9.3% to scoliosis, and 3.7% to lordosis.





CT scans play a pivotal role in assisting physiotherapists in evaluating specific conditions or injuries through various modalities. The majority, constituting 77% of CT scans; provide detailed images of bones, offering intricate insights into bone structures, fractures, and density, which are essential for diagnosing and managing musculoskeletal disorders. Additionally, CT scans visualize internal organs, a feature found in 7% of cases, aiding in the assessment of conditions affecting organs such as the lungs, liver, and kidneys, which may impact musculoskeletal health and treatment approaches.

Furthermore, 11% of CT scans focus on assessing joint abnormalities, offering detailed imaging of joints to diagnose issues like osteoarthritis, degenerative changes, and dislocations accurately. This comprehensive imaging capability empowers physiotherapists to make informed decisions regarding treatment strategies tailored to each patient's specific needs, ultimately enhancing clinical outcomes and patient care in the field of physiotherapy.

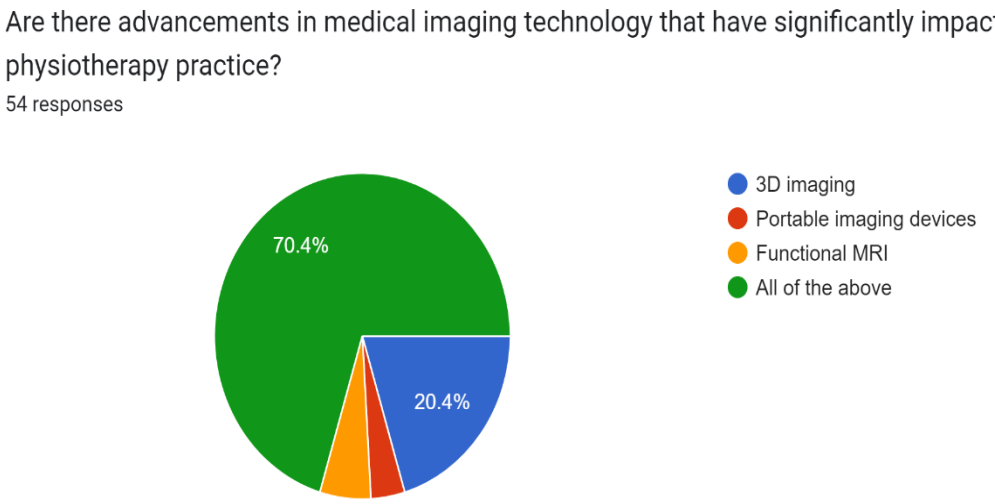
CT scans are crucial for physiotherapists in complex cases (74%), unclear diagnoses (11%), and persistent symptoms (3%), providing detailed insights and guiding tailored treatment strategies. They enhance diagnostic accuracy, refine treatment plans, and improve patient outcomes in physiotherapy.

Yes, there are potential risks and limitations associated with the use of medical imaging in physiotherapy, with 66% of respondents highlighting radiation exposure as a concern. This exposure can pose health risks over time, especially with repeated scans. Additionally, 18% of respondents identified radiation exposure as a specific risk. Another limitation is the limited soft tissue detail provided by certain imaging modalities, which may impact diagnostic

accuracy, as indicated by 13% of respondents. Moreover, the high cost associated with medical imaging procedures was cited as a limitation by a proportion of respondents. Therefore, all of the above options represent potential risks or limitations associated with the use of medical imaging in physiotherapy.

Advancements in medical imaging technology have notably influenced physiotherapy practice. The widespread adoption of 3D imaging, representing 70% of responses, has revolutionized the visualization of musculoskeletal structures, offering detailed three-dimensional representations for precise diagnosis and treatment planning. Portable imaging devices, accounting for 3.5% of advancements, have introduced flexibility by enabling on-site imaging assessments, facilitating prompt decision-making at the point of care.

Functional MRI, cited by 5.5% of respondents, has emerged as a valuable tool in understanding brain activity related to movement and pain perception, guiding personalized treatment approaches and enhancing rehabilitation interventions. These advancements collectively empower physiotherapists with improved diagnostic accuracy, targeted interventions, and ultimately, enhanced patient outcomes.



Have you encountered challenges in accurately discerning the positions of bones and organs upon reviewing scans? Approximately 12% of physiotherapists have reported difficulties in interpreting the precise positioning of bones and tissues in medical imaging scans. These issues may arise due to the complexity of certain anatomical structures or variations in imaging techniques. As such, it's essential for physiotherapists to receive adequate training and remain updated with advancements in imaging technology to enhance their proficiency in accurately interpreting scans and optimizing patient care.

In our study, we found that medical imaging plays a prevalent role in physiotherapy, with 83% utilizing X-rays, 9% opting for CT scans, and 3.7% utilizing MRI, while ultrasound (USG) accounts for the remaining percentage.

MRI aids in identifying various spinal conditions, with 87% of cases related to kyphosis, 9.3% to scoliosis, and 3.7% to lordosis. CT scans are pivotal in assisting physiotherapists, providing detailed images of bones in 77% of cases, visualizing internal organs in 7%, and assessing joint abnormalities in 11%. These capabilities empower tailored treatment strategies, enhancing clinical outcomes. Furthermore, CT scans are crucial for physiotherapists in complex cases (74%), unclear diagnoses (11%), and persistent symptoms (3%), enhancing diagnostic accuracy and refining treatment plans. However, potential risks include radiation exposure, limited soft tissue detail, and high cost, highlighting the importance of careful consideration in medical imaging utilization. Overall, advancements in medical imaging have significantly impacted physiotherapy practice, improving diagnostic precision and patient care.

Discussion

Accurate Diagnosis: Medical imaging offers physiotherapists detailed visual access to the body's internal structures, including bones, muscles, tendons, ligaments, and soft tissues. This capability enables precise identification of musculoskeletal injuries, conditions, and pathologies, complementing findings from physical examinations. By revealing the underlying causes of pain, dysfunction, and movement restrictions, imaging guides the development of tailored treatment strategies.

Treatment Planning: Once a diagnosis is established, medical imaging aids physiotherapists in designing personalized treatment plans aligned with each patient's unique needs and goals. By visualizing the extent of tissue damage and anatomical abnormalities, therapists can determine the most effective interventions to address deficits and promote optimal recovery. Imaging data inform the selection of therapeutic exercises, manual therapies, and rehabilitation techniques, thereby optimizing treatment outcomes (Shi.& Wu., 2023).

Monitoring Progress: Medical imaging facilitates the objective assessment of tissue healing, functional improvements, and treatment response over time (Boos, N., 2008). Through the comparison of successive imaging studies, physiotherapists can monitor post-injury or post-surgical healing, evaluate the effectiveness of rehabilitation, and adjust treatment protocols as necessary.

Progress monitoring via imaging aids in outcome evaluation and guides decisions regarding the resumption of activities or sports (Boyles et al., 2011).

The inclusion of medical imaging in physiotherapy practice significantly enhances the assessment, diagnosis, and treatment of musculoskeletal conditions. Physiotherapists utilize various imaging modalities to gain valuable insights into the underlying structures and pathologies affecting their patients (Shi.& Wu., 2023). X-rays provide detailed images of bones, aiding in the detection of fractures, joint degeneration, and alignment abnormalities. CT scans offer high-resolution cross-sectional images, allowing for precise evaluation of bone and soft tissue injuries, as well as internal organ involvement. MRI, with its superior soft tissue contrast, is particularly valuable in assessing ligament and tendon injuries, spinal conditions, and soft tissue abnormalities (Hetta. & Niazi. 2014). Ultrasound provides real-time imaging of soft tissues, allowing physiotherapists to assess muscle integrity, tendon integrity, and joint effusion. By incorporating medical imaging into their practice, physiotherapists can accurately diagnose musculoskeletal conditions, monitor treatment progress, and tailor interventions to meet the individual needs of their patients. This multidisciplinary approach ensures comprehensive care and optimal outcomes for patients undergoing physiotherapy (Hetta. & Niazi., 2014).

Differential Diagnosis: In cases where the cause of symptoms is unclear or multiple potential diagnoses exist, medical imaging assists physiotherapists in ruling out certain conditions and narrowing down the list of possible causes. Imaging data complement clinical assessments, helping therapists differentiate between various musculoskeletal pathologies, identify red flags, and guide further diagnostic investigations or specialist referrals when appropriate (Hetta. & Niazi., 2014).

Conclusion

It's evident that medical imaging plays a crucial role in physiotherapy, enabling precise diagnosis and effective treatment of musculoskeletal conditions. With a significant percentage of physiotherapists utilizing X-rays, CT scans, MRI, and ultrasound, it's clear that these modalities are integral to the field. MRI is particularly valuable in identifying various spinal conditions, such as kyphosis, scoliosis, and lordosis. CT scans provide detailed images of bones, visualize internal organs, and assess joint abnormalities, empowering physiotherapists to make informed treatment decisions tailored to each patient's needs. Moreover, advancements in medical imaging have significantly impacted physiotherapy practice, enhancing diagnostic accuracy and patient outcomes.

However, potential risks such as radiation exposure and limitations in soft tissue detail highlight the importance of careful consideration in medical imaging utilization. Overall, medical imaging remains a vital tool in physiotherapy, contributing to comprehensive patient care and advancing musculoskeletal rehabilitation.

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The Art of Innovation through Design Thinking Initiatives

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Abstract

Design thinking has emerged as a potent strategy for problem-solving and innovation across diverse fields. This abstract explores the core principles and processes of design thinking, highlighting its iterative nature, focus on human-centered design, and emphasis on empathy, creativity, and collaboration. It examines how design thinking drives innovation by combining analytical rigor with creative intuition to address complex challenges and unlock novel opportunities. By embracing ambiguity and reframing problems as opportunities, design thinking empowers individuals and teams to challenge conventional thinking and develop solutions that deeply resonate with end-users. Through its human-centered approach, design thinking fosters empathy, enabling the creation of solutions tailored to meet the diverse needs of users. This abstract shed light on how innovation flourishes through the application of design thinking principles, revolutionizing industries and shaping a brighter future. Additionally, it underscores the importance of gathering perspectives from various users through online surveys to ensure that solutions are inclusive and effective.

Introduction

Design thinking offers a unique perspective, allowing individuals to view the world through the eyes of the user and create solutions that address their needs. In today's rapidly evolving landscape, where customer preferences dictate decision-making across industries, organizations must adapt to meet customer demands effectively. Design thinking facilitates this adaptation by enabling organizations to anticipate and respond to customer needs proactively. Despite being extensively studied within the design field, the practical application and conceptualization of design thinking remain subjects of ongoing exploration. This paper aims to clarify existing knowledge on design thinking and systematize its teachings, particularly focusing on its effective application in various contexts. Through an examination of relevant literature and case studies, this paper provides a comprehensive overview of design thinking principles, methodologies, and their transformative impact on organizations. Furthermore, it emphasizes the importance of gathering perspectives from

various users through online surveys to ensure that design solutions are tailored to meet diverse needs effectively, thus enhancing inclusivity and effectiveness.

Literature Review

1. **"Design Thinking: Integrating Innovation, Customer Experience, and Brand Value" by Thomas Lockwood and Edgar Papke (2010):** This book provides a comprehensive exploration of design thinking, emphasizing its integration with innovation, customer experience, and brand value. Authors delve into the principles and methodologies of design thinking, showcasing real-world examples of its application across various industries. They highlight the importance of empathy, ideation, prototyping, and iteration in the design thinking process, offering valuable insights for both practitioners and scholars.

2. **"Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by Tim Brown (2009):** Tim Brown, the CEO of IDEO, a global design and innovation consultancy, presents a compelling argument for the transformative power of design thinking in this book. Brown illustrates how design thinking can drive organizational change and foster innovation by placing emphasis on human-centered solutions, collaboration, and experimentation. Drawing on numerous case studies, Brown demonstrates how design thinking has been successfully applied in diverse contexts, from product design to social innovation.

3. **"Designing for Growth: A Design Thinking Toolkit for Managers" by Jeanne Liedtka and Tim Ogilvie (2011):** Liedtka and Ogilvie provide a practical guide to applying design thinking principles in a business context. They offer a toolkit of methods and techniques for fostering innovation, including journey mapping, rapid prototyping, and design criteria setting, and they illustrate these concepts through real-world case studies.

4. **"Creative Confidence: Unleashing the Creative Potential Within Us All" by Tom Kelley and David Kelley (2013):** Tom Kelley and David Kelley, co-founders of IDEO, explore how individuals and organizations can cultivate creative confidence through design thinking. They provide insights into overcoming fear of failure, fostering a culture of innovation, and unleashing creative potential to tackle challenges.

5. **"The Designful Company: How to Build a Culture of Nonstop Innovation" by Marty Neumeier (2008):** Neumeier explores the relationship between design thinking and organizational culture, arguing that a designful company is one that fosters a culture of continuous innovation.

He offers strategies for integrating design thinking into every aspect of an organization, from strategy and leadership to product development and marketing.

6. **"Design thinking for innovation: context factors, process and outcomes" by Nicolas Rösch, Victor Tiberius and Sascha Kraus (2023):** This study proposes a system, which recognizes individual and organizational setting variables, the stages of a normal plan considering handle with its basic standards and apparatuses and the person as well as organizational results of a plan considering project.

Research Gap

In the current body of literature concerning the utilization of design thinking initiatives to drive innovation, there exists a notable void in comprehending the intricate relationship between organizational culture and the efficacy of design thinking methodologies. While previous studies have acknowledged the significance of organizational context in influencing innovation outcomes, there is limited empirical exploration into the specific cultural elements within organizations that impact the adoption, implementation, and sustained effectiveness of design thinking practices.

Addressing this gap is imperative for developing a thorough understanding of how organizational culture influences innovation through design thinking and for devising customized strategies to optimize the integration of design thinking principles across various organizational environments.

Objectives

This research paper aims to explore the comprehensive domain of design thinking, focusing on its fundamental principles and methodologies. It will delve into the essence of design thinking, emphasizing its user-centric approach and the crucial role of problem framing and reframing. Through analysis, the paper will uncover the iterative processes of prototyping and testing within design thinking and their significant impact on product development and problem-solving. Additionally, it will investigate the paramount importance of empathy and understanding in driving innovation, alongside the collaborative essence of creativity inherent in design thinking. Moreover, the paper will evaluate strategies for nurturing an innovative mindset within organizations by embracing and integrating design thinking methodologies, including gathering information through conducting online surveys to understand user needs and preferences effectively.

Research Methodology

1. **Research Design:** This study employed a quantitative research design to explore the phenomenon of innovation through design thinking initiatives. Specifically, a cross-sectional approach was utilized to collect data at a single point in time.

2. **Research Approach:** The research approach adopted was descriptive, aiming to provide an understanding of the current state of innovation through design thinking initiatives among participants.

3. **Sampling:** Convenience sampling was utilized to gather responses from individuals by reaching them through social media, emails, and online forums.. A total of 50+ responses were collected via a Google Form survey. The survey targeted individuals across various fields.

4. **Data Collection Instrument:** A structured questionnaire was developed using Google Forms to collect data. The questionnaire comprised items designed to assess participants' perceptions, experiences, and practices regarding innovation through design thinking initiatives. The questions were meticulously crafted to cover key aspects of the topic.

5. **Data Collection Procedure:** The Google Form survey which is consisted of 10-15 questions was distributed electronically via email, social media platforms, and professional networks. Participants were provided with clear instructions on completing the survey and assured of the confidentiality of their responses.

6. **Data Analysis:** Data analysis employed descriptive statistics, including frequencies and percentages, to summarize the survey responses. The collected data were tabulated and analysed to identify trends, patterns, and key findings related to innovation through design thinking initiatives.

7. **Validity and Reliability:** To ensure the validity of the survey instrument, careful attention was paid to the clarity and relevance of the questionnaire items. Additionally, pilot testing was conducted to refine the survey instrument and assess its appropriateness. Reliability was established through the use of standardized survey items and a consistent data collection process.

8. **Ethical Considerations:** Ethical considerations were prioritized throughout the research process. Measures were implemented to ensure participant confidentiality and anonymity, and informed consent was obtained from all

participants. The study adhered to ethical guidelines and regulations governing research involving human participants.

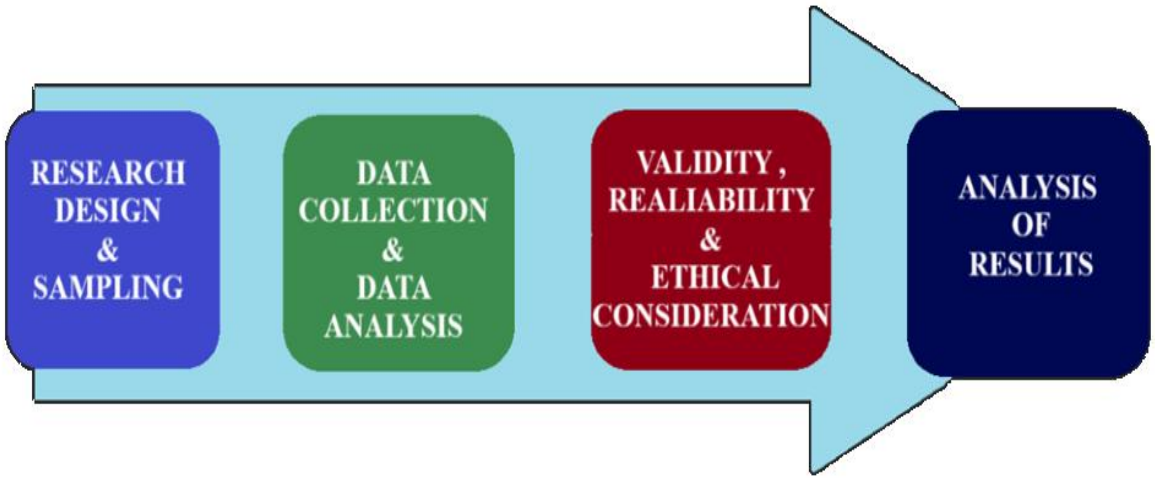


Figure 1: Flowchart

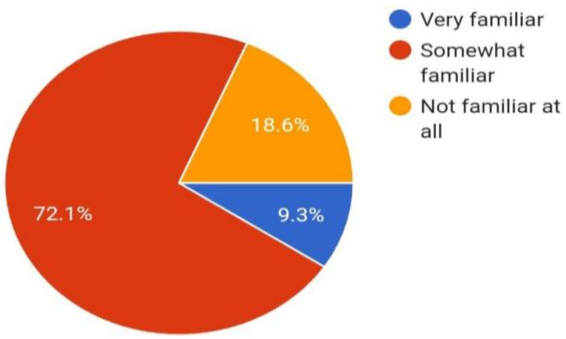
Findings & Results

The examination of the dataset contains a varied distribution across age groups, with the combined 18-20 age bracket constituting the majority at 72.1%. Specifically, 9.3% of individuals are aged 18, 39.5% are aged 19, and 23.3% are aged 20. Furthermore, a substantial proportion, totalling 27.9%, falls within the age range of 21-47, suggesting a diverse demographic representation extending beyond the younger cohort.

Survey Results

1. How familiar are you with the concept of design thinking?

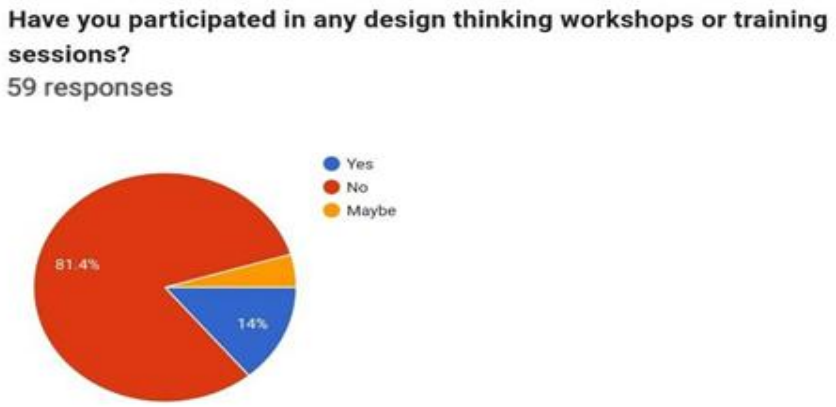
59 responses



- Very familiar: 9.3% of respondents consider themselves very familiar with design thinking.
- Somewhat familiar: 72.1% report being somewhat familiar with the concept.
- Not at all familiar: 18.6% indicate that they are not at all familiar with design thinking.

This suggests that while a majority of respondents have some degree of familiarity with design thinking, only a small fraction consider themselves highly knowledgeable on the topic. Conversely, a significant minority is completely unfamiliar with it.

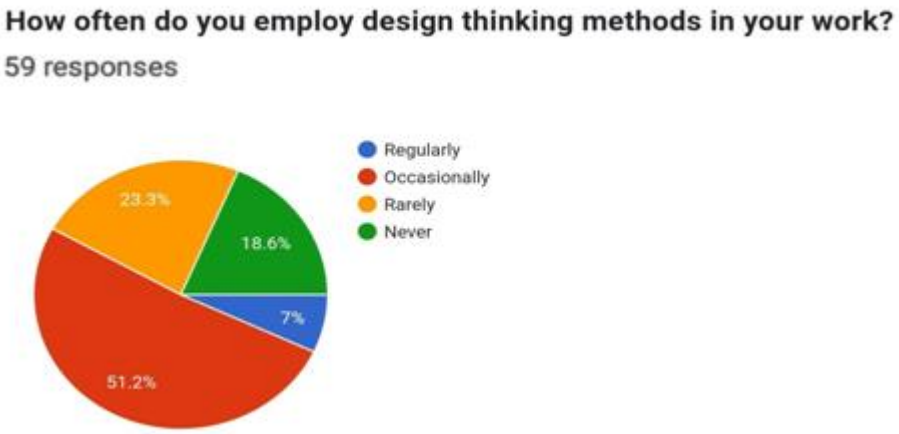
2.



- Yes: 14% of respondents have participated in design thinking workshops or training sessions.
- No: 81.4% of respondents have not participated in any such workshops or sessions.
- Maybe: 4.6% of respondents are unsure if they have participated in design thinking workshops or training sessions.

This indicates that a clear majority have not participated in any design thinking training, with a small minority being unsure about their participation.

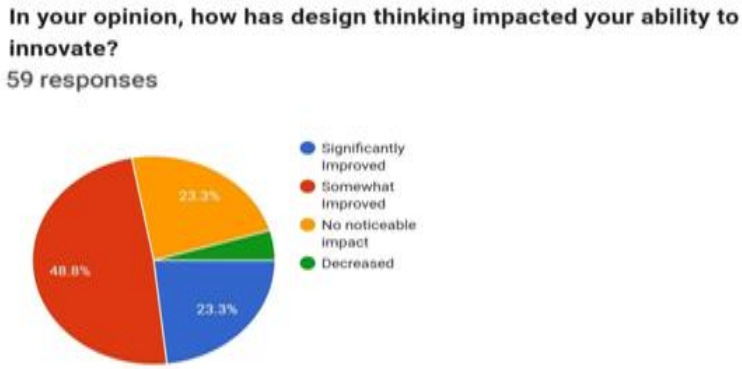
3.



- Regularly: 7% of respondents use design thinking methods regularly in their work.
- Occasionally: 51.2% use these methods occasionally.
- Rarely: 23.3% rarely use design thinking methods.
- Never: 18.6% have never used design thinking methods in their work.

This suggests that while a significant portion of respondents engage with design thinking methods at least occasionally, a smaller fraction uses them regularly. Conversely, a substantial minority has either rarely or never used these methods.

4.

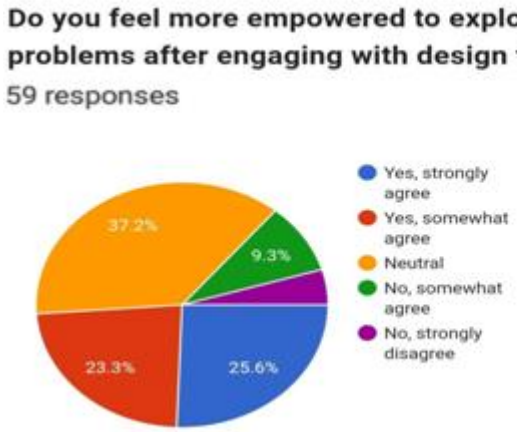


- Significantly improved: 23.3% of respondents feel that design thinking has significantly improved their ability to innovate.
- Somewhat improved: 48.8% report that design thinking has somewhat improved their innovation capabilities.
- No noticeable impact: 23.3% have not noticed any impact from using design thinking on their ability to innovate.

- Decreased: 4.6% believe that design thinking has actually decreased their ability to innovate.

Overall, these results indicate that a majority of respondents perceive a positive impact on their innovation abilities due to design thinking, though there are some who see no change or a negative effect. Yes, strongly agree: 25.6% of respondents strongly agree that design thinking has empowered them to explore creative solutions.

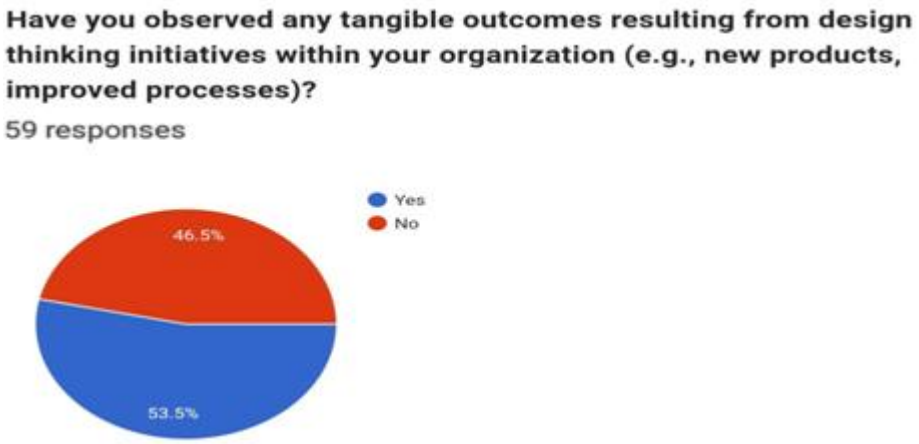
5.



- Yes somewhat agree: 23.3% somewhat agree with this statement.
- Neutral: 37.2% are neutral indicating neither agreement nor disagreement.
- No somewhat disagree: 9.3% somewhat disagree that design thinking has empowered them.
- No strongly disagree: 4.6% strongly disagree.

This indicates that nearly half of the respondents feel empowered by design thinking to some extent, while a significant proportion remain neutral. A smaller percentage disagrees with the idea that design thinking has enhanced their ability to explore creative solutions.

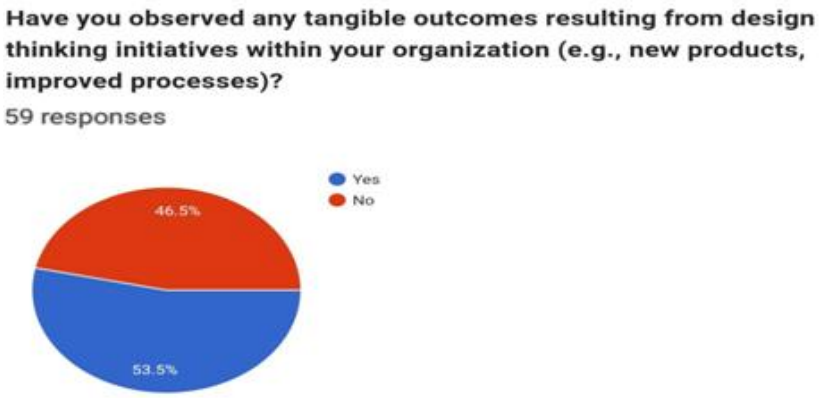
6.



- Yes: 53.5% of respondents have observed tangible outcomes, such as new products or improved processes, resulting from design thinking initiatives.
- No: 46.5% have not observed any tangible outcomes from these initiatives.

This suggests that slightly more than half of the participants have seen concrete results from employing design thinking strategies in their organizations, while a substantial minority has not noticed such outcomes.

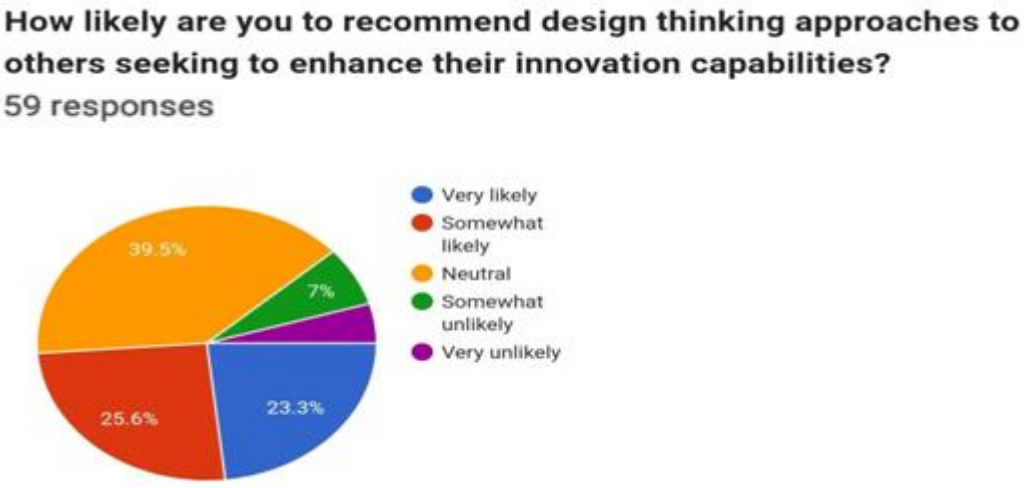
7.



- (Not effective at all): 4.6% of respondents rate design thinking initiatives as not effective at all.
- 9.3% give it a rating of 2, indicating low effectiveness.
- (Neutral): 60.5% rate it as neutral, suggesting neither positive nor negative effectiveness.
- 14% consider these initiatives to be quite effective, giving a rating of 4.
- (Extremely effective): 11.6% rate the effectiveness as extremely high, giving the top score.

This reveals that the majority of respondents feel neutral about the effectiveness of design thinking initiatives in fostering innovation, while there's a fairly balanced distribution among those who perceive it positively and those who view it negatively.

8.



- Very likely: 23.3%
- Somewhat likely: 25.6%
- Neutral: 39.5%
- Somewhat unlikely: 7%
- Very unlikely: 4.6%

It indicates that there's a significant portion of people who are either neutral or somewhat likely to recommend design thinking approaches, with a smaller percentage leaning towards very likely or somewhat unlikely. The fact that nearly 40% are neutral might suggest that there's still some uncertainty or variability in how effective people perceive design thinking to be for enhancing innovation capabilities. It could also indicate that the effectiveness of design thinking approaches might depend on various factors such as the context, industry or individual preferences.

Main Findings and Significance: In our survey journey through the realm of design thinking, we've uncovered a rich tapestry of perspectives that illuminate its adoption and utilization. Our findings reveal a landscape where design thinking enjoys varying degrees of recognition and engagement among participants. While the concept is not unfamiliar to most, deeper immersion through workshops or training remains relatively limited, suggesting opportunities for broader dissemination and education in this domain.

Interestingly, despite the widespread awareness of design thinking, its integration into everyday work practices appears sporadic, with only a minority reporting regular usage. Nevertheless, a significant number acknowledge its role in nurturing innovation, albeit with differing levels of perceived impact. This divergence extends to the evaluation of tangible outcomes, where although a

slight majority recognizes concrete results, a noteworthy segment remains uncertain of its effectiveness.

Moreover, the survey underscores a nuanced sentiment regarding the empowerment bestowed by design thinking in fostering creativity. While many express agreements with its ability to spark inventive solutions, a substantial portion remains ambivalent or sceptical of its transformative potential. This underscores the multifaceted nature of measuring the subjective experience of innovation.

Likewise, perceptions concerning the effectiveness of design thinking initiatives encompass a spectrum of viewpoints, with a significant portion adopting a neutral stance. This neutrality may signal not only the diverse contexts in which design thinking is applied but also the inherent variability in its outcomes. It emphasizes the importance of understanding the intricate interplay of factors influencing its efficacy, including organizational culture, leadership support, and alignment with specific challenges.

In essence, our findings underscore the dynamic nature of design thinking as both a philosophy and a practical approach. While it holds promise as a catalyst for innovation and problem-solving, its realization hinges on a multitude of factors, including organizational readiness, cultural resonance, and ongoing learning and adaptation. Embracing design thinking represents not just a strategy for organizational survival, but an opportunity for transformative growth. By cultivating a culture of experimentation, collaboration, and empathy, organizations can unlock the full potential of design thinking to address today's most complex challenges and forge a more resilient and adaptive future.

Conclusion

Our exploration of design thinking has shed light on its diverse nature and potential for transformative impact. While varying degrees of recognition exist, there's an opportunity for broader dissemination and deeper immersion through educational initiatives. Despite widespread awareness, its integration into daily work practices remains sporadic, indicating the need for concerted efforts to embed it into organizational cultures. Nevertheless, there's consensus on its role in fostering innovation, albeit with differing perceptions of its effectiveness.

The nuanced perspectives on design thinking's ability to empower creativity highlight the challenge of measuring its impact. Similarly, perceptions of its effectiveness vary, reflecting the diverse contexts of its application. Embracing design thinking presents an opportunity for organizations to foster

innovation, collaboration, and empathy, navigating complex challenges for a more resilient future.

Limitations

- **Sampling Bias:** Online surveys may not accurately represent all demographic groups, potentially introducing biases into the findings. For instance, individuals lacking internet access or with limited technological proficiency may be underrepresented. Additionally, certain demographics like the elderly or rural residents might exhibit lower participation rates, leading to skewed results.

- **Self-Selection Bias:** If the survey was shared on design-related forums or social media groups, it may have attracted respondents with a specific interest in design, potentially skewing the findings towards their perspectives.

- **Limited Depth:** Surveys may provide surface-level insights compared to more in-depth research methods such as interviews or observations.

- **Reliance on Self-Report:** Responses are susceptible to biases such as social desirability or memory recall, potentially affecting the accuracy of the data.

- **Potential Response Bias:** Respondents might provide inaccurate or incomplete information due to various factors such as survey fatigue, distractions, or the inclination to present themselves positively. These tendencies are typical in online surveys and can influence the reliability of the collected data.

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Mapping the Social Perception of Design

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Abstract

This paper presents to map social perception of design using among a diverse sample of participants. Utilizing Google Forms, the study seeks to explore individuals' perceptions of design and their attitudes towards its role in society. Key questions focused on understanding the importance of design in everyday life, perceptions of different design disciplines, and factors. The study is based on responses from a range of demographic groups, providing valuable insights into how design is perceived across different segments of society. The findings highlight the significance of design in shaping consumer behavior, cultural norms, and societal values. Overall, this research contributes to a deeper understanding of the multifaceted nature of design perception and its implications for research, practice, and education in the field of design.

Keywords: Survey, Social perception, every day, Diversity, Design disciplines and Society

Introduction

Design permeates every aspect of our lives, from the products we use to the spaces we inhabit, influencing our experiences and interactions on a daily basis. In a world where design has become increasingly ubiquitous, it is essential to understand how it is perceived by the general public. The purpose of this survey, "Mapping the Social Perception of Design," was to delve into the intricate web of perceptions surrounding design and to gain insights into what people truly think about it.

Design is not merely about aesthetics; it is a powerful tool for communication, problem-solving, and innovation. Whether it's the layout of a website, the packaging of a product, or the architecture of a building, design has the ability to evoke emotions, convey messages, and shape behaviors. Yet, despite its pervasive presence, the perception of design remains subjective and multifaceted.

Through this survey, we aimed to uncover the diverse perspectives held by individuals regarding design. We sought to explore questions such as: What

role does design play in people's lives? How do they perceive different forms of design? What factors influence their opinions about design?

Understanding the social perception of design is crucial for several reasons. Firstly, it provides valuable insights for designers, allowing them to create products and experiences that resonate with their target audience. By gaining a deeper understanding of people's preferences and expectations, designers can better meet the needs and desires of consumers.

Moreover, the perception of design is not limited to the realm of aesthetics; it also reflects broader societal values and norms. By examining how design is perceived in different cultural contexts, we can gain a better understanding of the role that design plays in shaping social behaviors and attitudes.

Ultimately, by mapping the social perception of design, we hope to contribute to a richer understanding of this complex and multifaceted phenomenon. Our findings have the potential to inform future research, practice, and education in the field of design, ultimately fostering a greater appreciation for the importance and impact of design in our lives.

Literature Review

Design perception encompasses the subjective interpretation and evaluation of designed artifacts by individuals within society. Understanding design perception is crucial as it sheds light on how people interact with and derive meaning from various forms of design, ranging from products and services to environments and experiences. This perception is influenced by a myriad of factors, including cultural norms, personal experiences, and cognitive processes, which collectively shape individuals' attitudes, preferences, and behaviors towards design.

Despite the progress made in understanding design perception, several challenges remain. Methodological limitations, such as the reliance on self-report measures and the under-representation of certain demographic groups, pose barriers to obtaining comprehensive insights into design perception. Future research should address these challenges by employing mixed-methods approaches and ensuring diverse participant representation. Additionally, advancing our understanding of design perception in emerging contexts, such as digital environments and global markets, presents exciting opportunities for future inquiry.

Research Gap

- Underrepresentation of Specific Demographic Groups
- Limited Focus on Emerging Design Contexts
- Methodological Constraints and Bias

Objectives

- To explore individuals' perceptions of design across different demographic groups and socio-cultural contexts.
- To identify key factors influencing design perception, including cultural norms, personal experiences, and cognitive processes.
- To examine the role of design perception in shaping consumer behavior, cultural trends, and societal values.
- To highlight practical applications of understanding design perception in various domains, such as product design, marketing, and public policy.
- To identify research gaps and future directions for advancing our understanding of the social perception of design.
- To provide recommendations for designers, educators, policymakers, and other stakeholders to promote a more nuanced understanding of design perception and foster inclusive design practices.

Hypothesis

- There is no significant difference in design perception across demographic groups and socio-cultural contexts.
- There are significant differences in design perception across demographic groups and socio-cultural contexts.
- Cultural norms and personal experiences do not significantly influence individuals' perceptions of design.
- Cultural norms and personal experiences significantly influence individuals' perceptions of design.
- Design perception does not significantly impact consumer behavior and societal values.
- Design perception significantly impacts consumer behavior and societal values.
- There is no significant association between design perception and the adoption of sustainable design practices.
- There is a significant association between design perception and the adoption of sustainable design practices.

Research Methodology

The survey "Mapping the Social Perception of Design" was conducted using a Google Form distributed to a diverse sample of participants through various online channels, including social media platforms, email lists, and online communities. The survey was open to individuals of all ages and backgrounds, with the aim of capturing a broad range of perspectives on the topic of design.

The Google Form was designed to collect both quantitative and qualitative data, allowing participants to respond to a series of structured questions as well as providing open-ended feedback. The survey consisted of [15] questions, covering topics such as the importance of design in everyday life, perceptions of different types of design (e.g., graphic design, interior design, product design), and factors influencing perceptions of design.

The sample size for the survey was [50] participants, which provided a robust dataset for analysis. Participants were drawn from diverse demographic backgrounds, including varying ages, genders, educational levels and occupations. Efforts were made to ensure a representative sample by actively promoting the survey across different platforms and reaching out to individuals from different demographic groups.

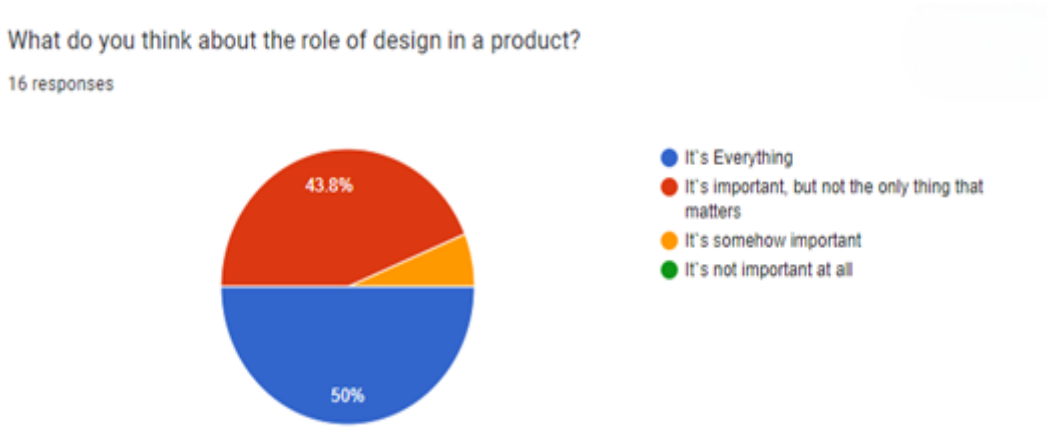
Demographic information collected from participants included age, gender, educational level, occupation, and geographic location. This information was used to analyze how perceptions of design may vary across different demographic groups and to ensure that the sample was representative of the broader population.

The survey was conducted anonymously to encourage honest and candid responses from participants. Participants were informed that their responses would be used for research purposes only and that their anonymity would be preserved.

Results

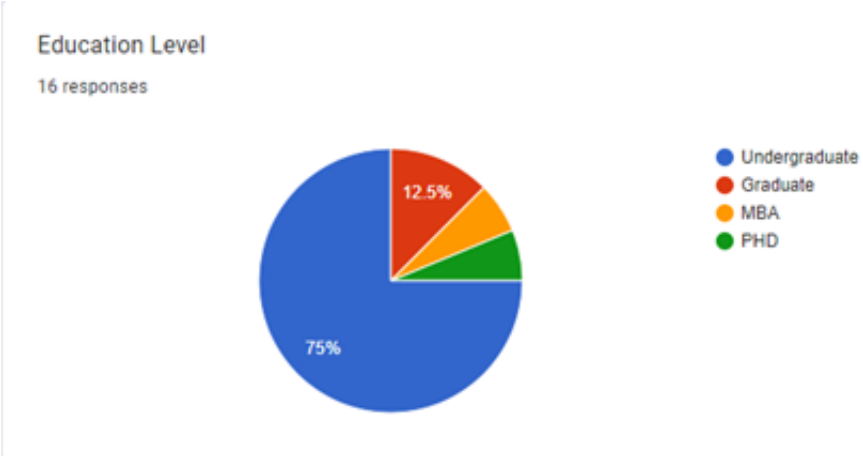
Interest in Design among 18-22 Age Group

The survey revealed that individuals in the age range of 18-22 exhibited a higher level of interest in design compared to other age groups. This demographic group showed a greater propensity to engage with the survey questions and expressed a keen interest in various aspects of design.



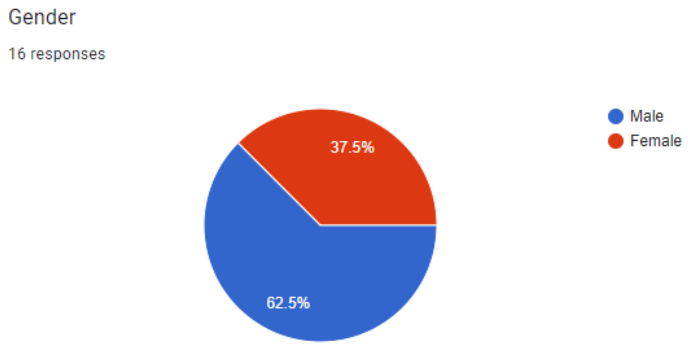
Perceptions of Design among Undergraduate Students

A significant portion of the respondents identified themselves as undergraduate students, indicating a strong interest in design within this demographic. This suggests that individuals pursuing higher education, particularly at the undergraduate level, are actively engaged in discussions and considerations related to design.



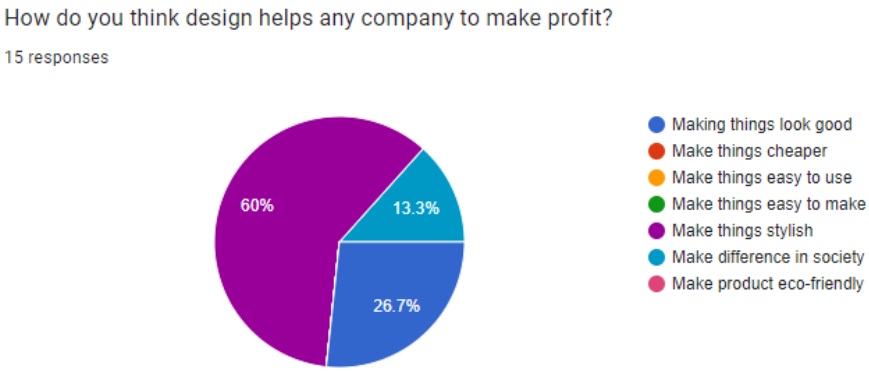
Perceptions of Design among Female Respondents

Among female respondents, there was a predominant association of design with fashion and interior design. This suggests that within this demographic, there is a particular focus on design as it pertains to aesthetics and personal expression, aligning with traditional gendered notions of design.

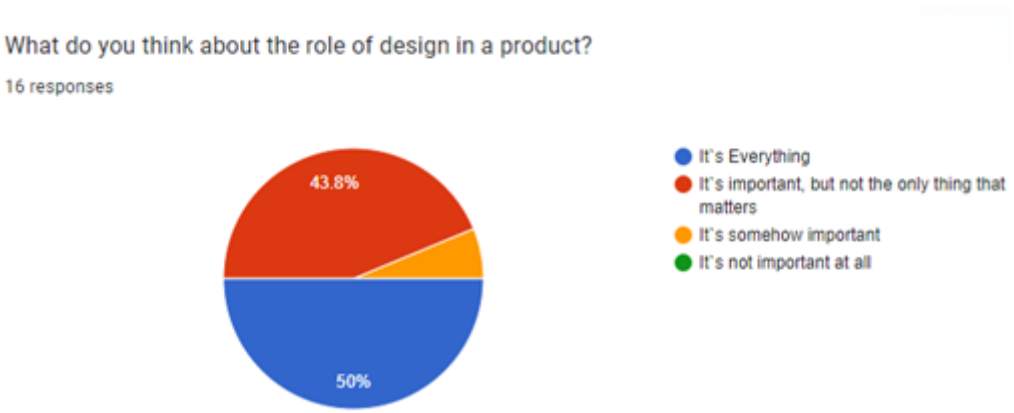


Perception of Design's Role in Company Profit

When asked about the role of design in a company's profitability, 50% of respondents indicated that design contributes to profitability by making products stylish. This highlights a common perception that design enhances the appeal of products, thereby influencing consumer preferences and purchasing decisions.



The perception that design contributes to a company's profitability by making products stylish is generally positive, as it reflects an understanding of the value that design can bring to businesses. Here's why it's considered a positive perception



These findings collectively suggest that there is a strong interest in design among younger demographics, particularly undergraduate students, with a particular emphasis on design's role in aesthetics, personal expression, and product perception. Additionally, there is a widespread recognition of design's influence on company profitability, particularly in terms of enhancing product appeal and differentiation. These insights can inform future research and practice in the field of design, highlighting the need to consider diverse perspectives and demographics when designing products and experiences.

These findings collectively suggest that there is a strong interest in design among younger demographics, particularly undergraduate students, with a particular emphasis on design's role in aesthetics, personal expression, and product perception. Additionally, there is a widespread recognition of design's influence on company profitability, particularly in terms of enhancing product appeal and differentiation. These insights can inform future research and practice in the field of design, highlighting the need to consider diverse perspectives and demographics when designing products and experiences.

Main Findings and Significance

The survey "Mapping the Social Perception of Design" provided valuable insights into how individuals perceive design, revealing several key findings with significant implications for future research and practice in the field of design.

- **Age and Interest in Design**

  A notable finding was the higher level of interest in design among individuals aged 18-22. This demographic exhibited a strong inclination towards design-related topics, indicating a potential shift in attitudes towards design among younger generations. Understanding this trend can inform design education and outreach efforts targeted at younger demographics.

- **Demographics of Respondents**

  The survey highlighted the predominance of undergraduate students among the respondents, suggesting a particular interest in design within this demographic. This underscores the importance of engaging with educational institutions to promote design literacy and foster a deeper understanding of design principles among students.

- **Gendered Perceptions of Design**

  Gender differences in perceptions of design were observed, with female respondents predominantly associating design with fashion and interior design. This suggests the need for greater diversity and inclusivity in design discourse, ensuring that the perspectives and experiences of all genders are represented and valued within the field of design.

- **Perception of Design's Role in Profitability**

  A significant proportion of respondents believed that design contributes to company profitability by making products stylish. This highlights the perceived importance of design in enhancing the marketability and appeal of products, emphasizing the strategic role of design in driving business success.

- **Significance of Design in Product Perception**

  The majority of respondents emphasized the essential role of design in a product, with many stating that it is everything. This underscores the widespread recognition of design as a critical factor in shaping consumer perceptions, influencing purchasing decisions, and differentiating products in the marketplace.

Recognition of Design's Impact

The fact that respondents attribute profitability to design suggests that they recognize the importance of aesthetics and appeal in attracting consumers. This aligns with research showing that well-designed products tend to perform better in the market.

- **Consumer Influence:** By acknowledging that stylish design enhances product appeal, respondents are also acknowledging the role of consumer preferences and purchasing decisions. This understanding can inform businesses' strategies for product development and marketing, helping them better meet the needs and desires of their target audience.

- **Competitive Advantage:** Companies that prioritize design and invest in creating stylish products often gain a competitive advantage in the marketplace. Consumers are drawn to products that not only fulfill their functional needs but also align with their aesthetic preferences, leading to increased sales and profitability.

Role of Design in Product Perception

The majority of respondents (61.1%) emphasized the significance of design in a product, with many stating that it is essential or even everything. This underscores the widespread recognition of design as a critical factor in shaping consumer perceptions, product differentiation, and overall success in the marketplace.

Conclusion

In conclusion, the survey "Mapping the Social Perception of Design" has provided valuable insights into the diverse perspectives surrounding design and its societal impact. As we navigate the ever-evolving landscape of design perception, it is essential to consider strategies for promoting design literacy among youth and improving the perception of design among companies.

To promote design among youth, it is crucial to engage them in meaningful and accessible ways. Design education programs should be developed to foster creativity, critical thinking, and empathy from an early age. By incorporating hands-on experiences, real-world projects, and exposure to diverse design disciplines, we can inspire the next generation of designers and instill a deeper appreciation for the role of design in shaping the world around us. Collaborations between schools, community organizations, and design professionals can create opportunities for mentorship, skill-building, and exploration, making design more accessible and inclusive for young people.

To improve the perception of design among companies, a shift in mindset is needed to recognize design as a strategic asset rather than merely a superficial aesthetic. Companies should invest in design leadership and integrate design thinking principles into their organizational culture. By prioritizing user-centered design, fostering interdisciplinary collaboration, and embracing experimentation and iteration, companies can create products and experiences that resonate with consumers and drive long-term success. Additionally, businesses should prioritize diversity and inclusivity in their design teams, ensuring that a wide range of perspectives and experiences are represented in the design process.

Ultimately, promoting design among youth and improving the perception of design among companies require a concerted effort from designers, educators, policymakers, and industry stakeholders. By working together to foster creativity, innovation, and inclusivity, we can harness the transformative power of design to address complex challenges, drive economic growth, and create a more equitable and sustainable future for all.

Limitations of Study

- **Sampling Bias**

The survey was only distributed online, it may have excluded individuals without internet access, leading to a bias towards internet-savvy participants. Additionally, if the survey was primarily shared within certain social circles or communities, it may not have captured perspectives from more diverse demographic groups.

- **Self-Selection Bias**

If the survey was shared on design-related forums or social media groups, it may have attracted respondents with a specific interest in design, potentially skewing the findings towards their perspectives.

Limited Scope of Questions

The scope of your survey questions may have been limited in terms of the breadth or depth of inquiry into design perception.

For example, if the survey only asked about perceptions of design's role in society and did not explore other dimensions such as design ethics, sustainability, or cultural influences, it may not have provided a comprehensive understanding of the topic.

- **Potential Response Bias**

Response bias may have influenced the results if respondents provided answers that they believed were expected of them, rather than reflecting their true opinions or experiences.

We would like to express our gratitude to all the participants who generously took the time to respond to our survey on mapping the social perception of design. Without their valuable input and insights, this research would not have been possible.

We acknowledge the assistance provided by Mr. Manish Joshi

Finally, we would like to thank our colleagues and advisors for their guidance and encouragement throughout the research process. Their expertise and feedback have been invaluable in shaping the design and analysis of the survey.

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Speculative Design in Healthcare

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Abstract

Early diagnosis is crucial for effective treatment and improved outcomes in healthcare, yet existing diagnostic approaches often fall short of fully leveraging emerging technologies and imaginative methodologies. By integrating speculative design principles, this research aims to push the boundaries of conventional diagnostic systems and envision novel solutions that anticipate future healthcare needs. Through interdisciplinary collaboration and user-centric design, our approach harnesses the power of speculative thinking to envision diagnostic systems capable of early detection across a diverse range of medical conditions. Drawing insights from fields such as artificial intelligence, sensor technology, and data analytics, we conceptualize intuitive interfaces that empower both healthcare professionals and patients in the diagnostic process.

Moreover, our methodology emphasizes the ethical, social, and cultural dimensions of healthcare innovation, ensuring that our speculative designs promote equity, inclusivity, and ethical integrity. By envisioning alternative futures and challenging established paradigms, we strive to catalyse transformative change in diagnostic practices, ultimately enhancing health outcomes and advancing the quality of life for individuals worldwide. This paper outlines the principles and methodologies underlying our speculative design approach to early diagnosis, offering insights into the potential of speculative thinking to drive innovation in healthcare. Through creative exploration and a commitment to foresight, we aim to pave the way for a future where early diagnosis is not only achievable but also seamlessly integrated into healthcare systems, revolutionizing the way we approach diagnosis and treatment.

Keywords: Speculative Design, Healthcare, Artificial Intelligence, Patient, Early Diagnosis

Introduction

Imaging Technology: Medical imaging has evolved tremendously, with modalities like MRI (Magnetic Resonance Imaging), CT (Computed Tomography), and ultrasound becoming increasingly sophisticated. These

technologies provide detailed insights into anatomical structures and aid in the diagnosis of conditions ranging from cancer to neurological disorders.

Point-of-Care Testing (POCT): POCT devices have become more accessible and versatile, allowing for rapid diagnostic testing outside of traditional laboratory settings. These include devices for blood glucose monitoring, infectious disease testing, and cardiac biomarker analysis, enabling quicker decision-making and improving patient outcomes.

Digital Health Solutions: The rise of digital health technologies, including wearable devices, mobile health apps, and telemedicine platforms, has transformed the diagnostic landscape. Remote monitoring tools capture real-time patient data, while AI algorithms analyses this data to detect abnormalities and facilitate early diagnosis of various health conditions.

Artificial Intelligence (AI): AI and machine learning algorithms are increasingly being integrated into diagnostic processes, enhancing accuracy and efficiency. These algorithms assist radiologists in interpreting medical images, aid pathologists in analyzing tissue samples, and support clinicians in making diagnostic decisions based on complex data sets.

Biosensors and Nanotechnology: Advances in biosensor technology and nanotechnology have led to the development of miniature diagnostic devices capable of detecting biomarkers at the molecular level. These devices hold promise for early detection of diseases such as cancer and infectious diseases, as well as monitoring of treatment response in real-time.

Literature Review

1. Rethinking how healthcare is conceptualized and delivered through speculative design in the UK and Malaysia: A Comparative study

Emmanuel Tsekleves, Min Hooi Yong, Clarissa Ai Ling Lee, Sabir Giga, Jung Shan Hwang & Sian Lun Lau
https://www.tandfonline.com/doi/pdf/10.1080/14606925.2019.1595430

The review

The paper discusses cross-cultural design-driven research employing participatory speculative design to explore alternative healthcare delivery methods, particularly in the context of ageing in the UK and Malaysia. It demonstrates the feasibility of speculative design in engaging vulnerable groups and suggests its potential for informing policy decisions to enhance engagement

with hard-to-reach populations, such as senior citizens, by fostering creativity and imagination.

2. Co-designing Design Fictions: A New Approach for Debating and Priming Future Healthcare Technologies and Services

1,2Imagination@Lancaster, LICA, Lancaster University, Lancaster, UK
3,4PDR International Centre for Design and Research, Cardiff Metropolitan University, Cardiff, Wales, UK https://imagination.lancaster.ac.uk/wp-content/uploads/2017/05/dffs_10553.pdf

The Review

Design fiction (DFs) are being utilized to engage individuals in discussions about future technologies and societal directions. The Proto Policy project explores how co-created DFs can help older citizens envision the implications of policy initiatives, particularly in the context of technology in ageing societies. Feedback from participants revealed themes such as increasing the acceptance of future healthcare technologies, raising ethical concerns, conceptualizing new healthcare services, and aiding in decision-making. The study suggests that co-designing DFs can offer valuable insights into citizens' perspectives on future healthcare technologies and services, facilitating their integration into healthcare systems.

3. Speculative Design in the present & future

Jordy Alblas, Nesrin Güneş, Sam Kragtwijk, Clarissa Schmitt
Master students in Industrial Design, Eindhoven University of Technology
https://www.nesringunes.com/wp-content/uploads/2020/12/Speculative-design-in-the-present-future_TPSI_M-1-1.pdf

The Review

This paper is based on a framework developed by Reon Brand of Philips Design, to explore potential future paradigms in healthcare through speculative design. By creating probes that provoke thought and discussion, insights were gained to challenge current societal thinking about preventive healthcare. One probe suggests allowing parents to develop an ideal gut flora for their baby, to promote a healthier life. Exhibiting this probe sparked engaging discussions and provided valuable insights into the future of healthcare.

4. Feel Good Future: How can speculative design be used as a tool to collaboratively reimagine mental health services and interventions in the UK?

Hanah Ahmed Dissertation MDes Service Design Ravensbourne University https://www.researchgate.net/profile/Hanah Ahmed/publication/365682236_Feel_Good_Future _How_can_speculative_design_be_used_as_a_tool_to_collaboratively_reimagine_mental_health_services_and_interventions_in_the_UK/links/637e341054eb5f547cf9076a/Feel-Good-Future-How-can-speculative-design-be-used-as-a-tool-to-collaboratively-reimagine-mental-health-services-and-interventions-in-the-UK.pdf

The Review

This paper addresses the rising challenges in mental health services in the UK, exacerbated by factors like insufficient funding and accessibility issues. Through a co-design workshop involving stakeholders, including individuals with lived experience, key problems such as funding shortages and stigma were identified. Speculative design tools were then used to envision desired futures for mental health care, highlighting themes like improved education and holistic care integration. The findings emphasize the urgent need for transformation in mental health care systems to provide sustainable, empathetic, and accessible services for all members of society

5. Artificial Intelligence in Healthcare

Abhinav, G V & Subrahmanyam S, Dr. (2019). Artificial Intelligence in Healthcare. Journal of Drug Delivery and Therapeutics. 9. 10.22270/jddt.v9i5-s.3634.(PDF) Artificial Intelligence in Healthcare (researchgate.net)

The review

AI Technology is itself self-sufficient and has a huge scope when it comes to enhancing the current state of healthcare. Health organizations must quickly adapt to evolving technologies, regulations, and consumer demands. AI is also helpful in robot-assisted surgery, diagnosing, diseases like cancer at its earlier stages.

6. *Design* research in healthcare: a systematic literature review of key design journals

Huynh-Dagher, Solène & Lamé, Guillaume & Duong, Tu Anh & Jankovic, Marija. (2022). Design research in healthcare: a systematic literature review of key design journals. Journal of Engineering Design. 33. 1-23. 10.1080/09544828.2022.2123702.

Design research in healthcare: A systematic literature review of key design journals: Journal of Engineering Design: Vol 33, No 8-9 - Get Access (tandfonline.com)

The review

The paper talks about specific design approaches and how poor design remains surprisingly pervasive. Patients hurt themselves with poorly designed products. Thus, a proper design system should be created for the patients.

Research Gap

Speculative design is widely used in other fields, but its applications in healthcare remain relatively unexplored, particularly in the context of early diagnosis. Certain limitations such as spending too much money, people not accepting the change, not having enough new technology ethical considerations & implementation challenges, etc.

Hypothesis

- Implementing speculative design principles in healthcare can lead to earlier diagnosis of medical conditions by enhancing patient engagement, encouraging proactive healthcare behaviors, and improving the effectiveness of diagnostic processes.

- Speculative design approaches, which envision future scenarios and prototypes, can lead to the development of more engaging, accessible, and personalized tools that empower individuals to participate in early diagnosis of health conditions.

Methodology

In the context of healthcare, speculative design involves envisioning potential future scenarios, technologies, and systems that could transform the way healthcare is delivered, experienced, and understood. It encourages designers, healthcare professionals, and other stakeholders to consider the broader social, cultural, and ethical implications of their work, beyond just the technical aspects.

The overall research was based on observational and quantitative:

Target Sample: A diverse group of participants from different backgrounds, including both design professionals and individuals from non-design fields.

Type of Sampling:

Selecting participants who may or may not have prior knowledge of speculative design. Ensure representation across various demographics to capture a broad range of perspectives.

Sample Size: a sample size of approximately 20-50 participants to get a robust understanding of awareness levels within the chosen population.

Tools to be used:

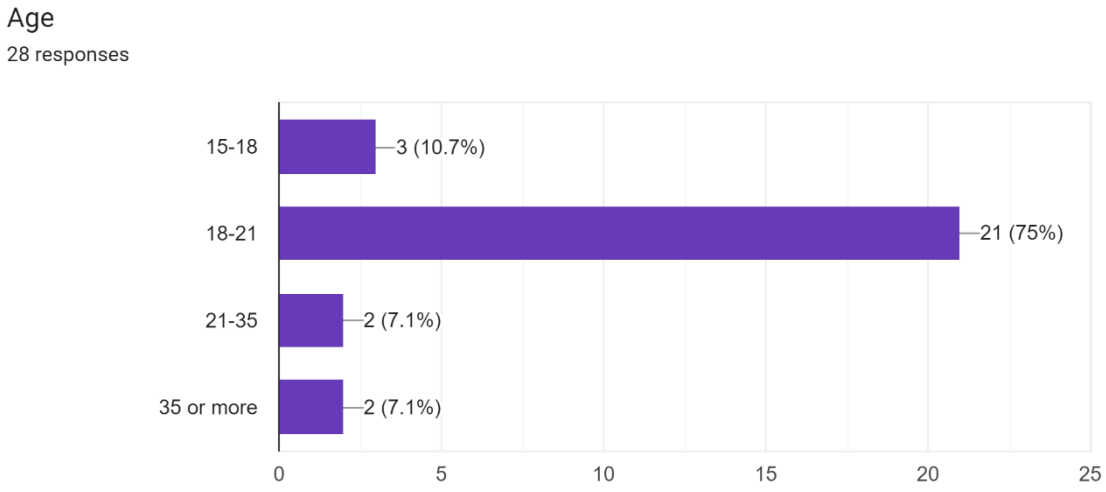
Interviews: Conduct semi-structured interviews with a subset of participants to gain more in-depth insights into their awareness levels, experiences, and opinions regarding speculative design.

Data Analysis: Qualitatively analyses interview data to extract nuanced perspectives on participants' knowledge and perceptions of speculative design.

Comparative Analysis: Compare awareness levels between design professionals and those from non-design backgrounds to identify any significant differences.

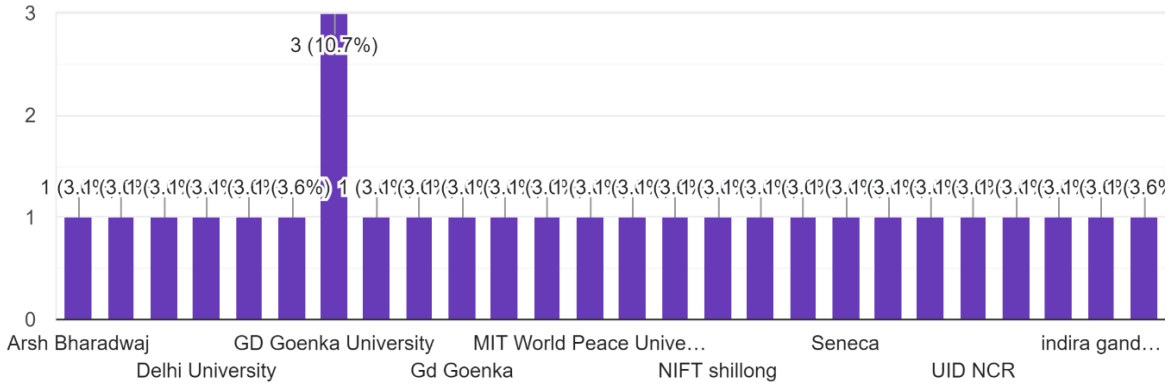
Explore correlations between awareness levels and demographic factors to understand potential patterns.

Results



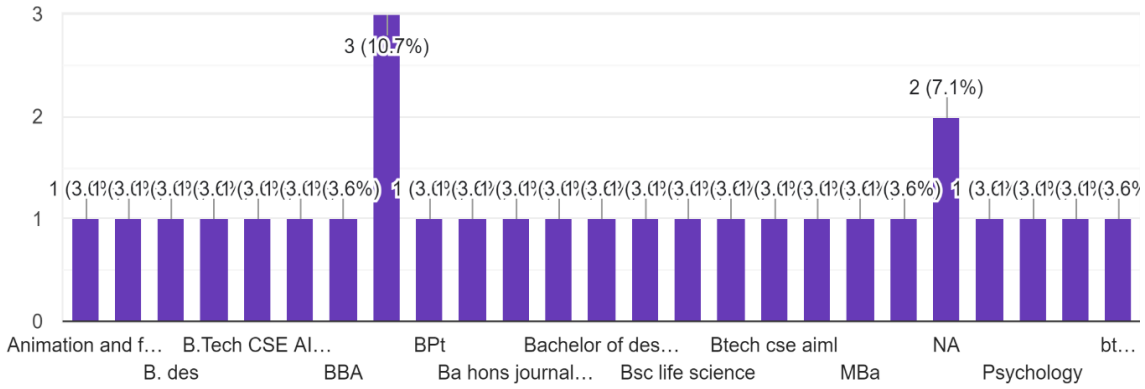
College Name

28 responses



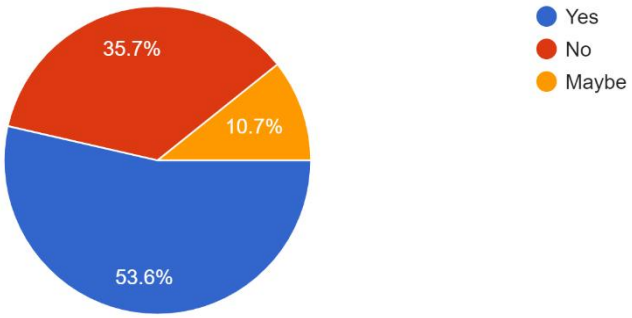
Course

28 responses



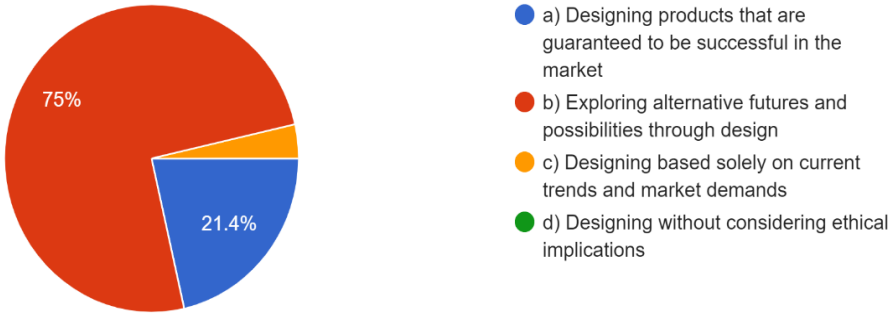
Are you aware with the term speculative design?

28 responses



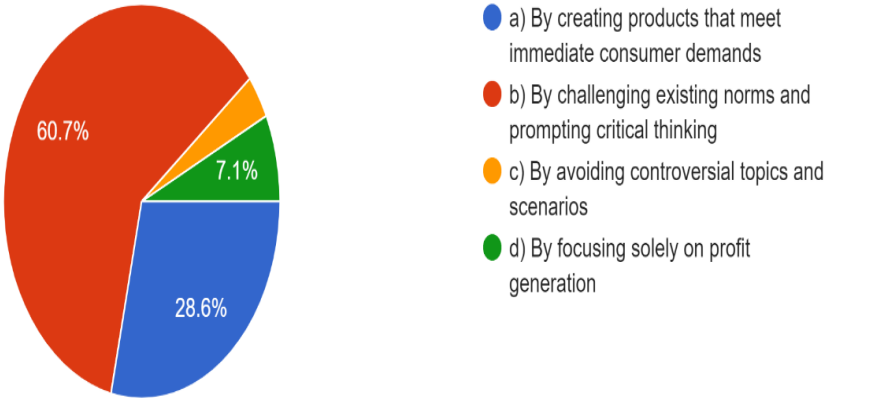
What do you understand with the term speculative design?

28 responses



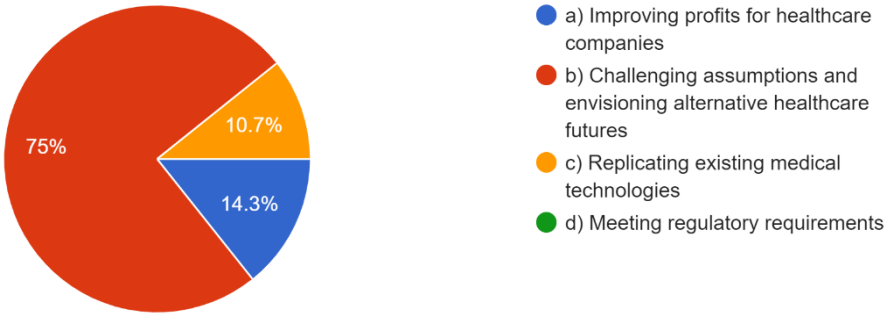
How can speculative design benefit society?

28 responses



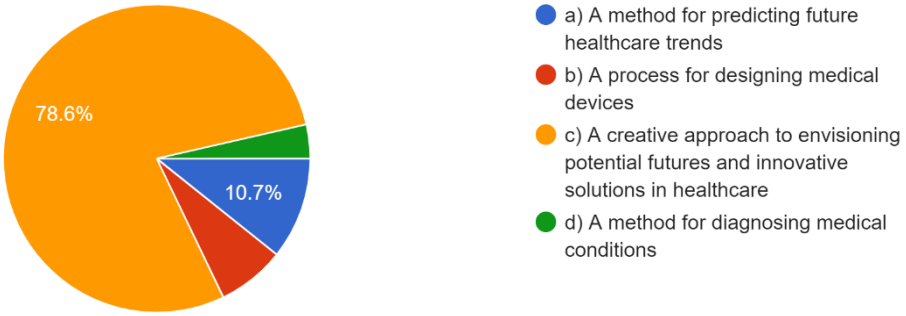
Which of the following do you think is a primary focus of speculative design in healthcare?

28 responses



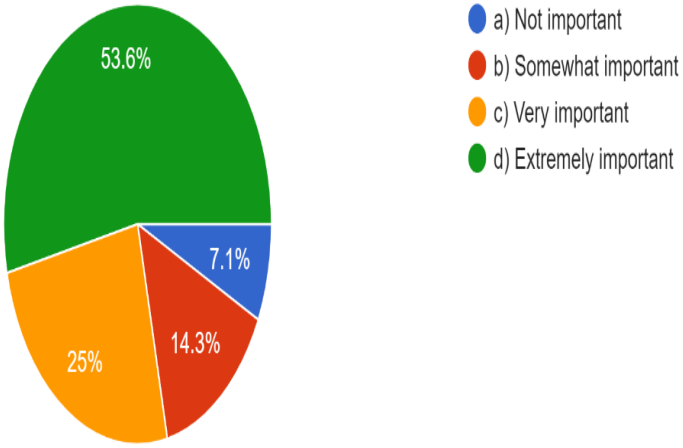
What is speculative design in healthcare?

28 responses



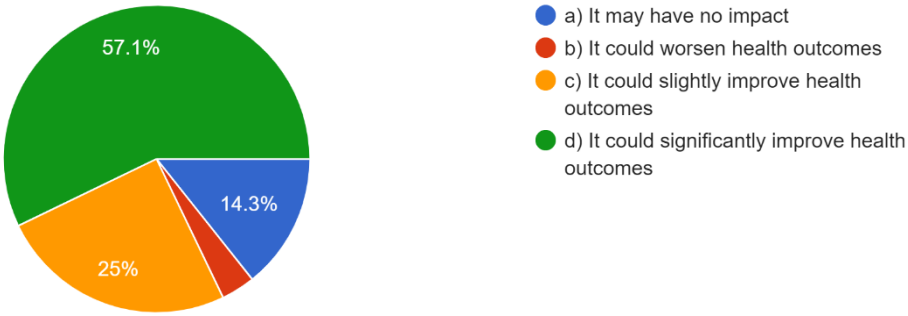
How crucial is early diagnosis for effective treatment and improved outcomes in healthcare?

28 responses



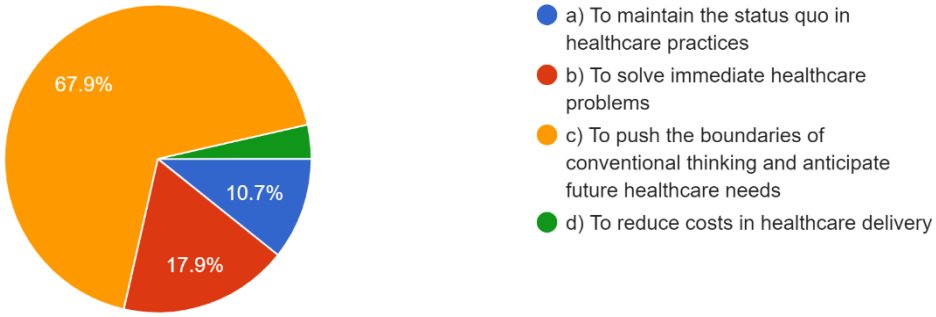
How might speculative design-driven innovation in healthcare impact health outcomes?

28 responses



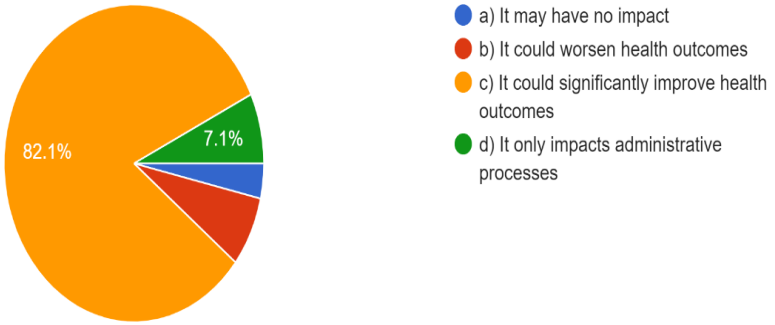
What is the primary objective of speculative design in healthcare?

28 responses



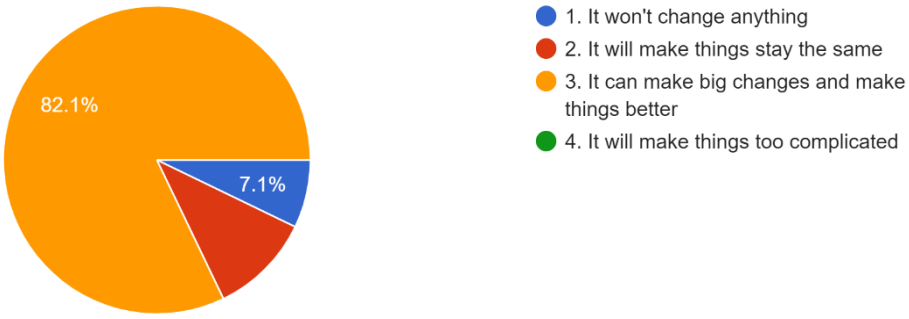
How might speculative design-driven innovation impact healthcare outcomes?

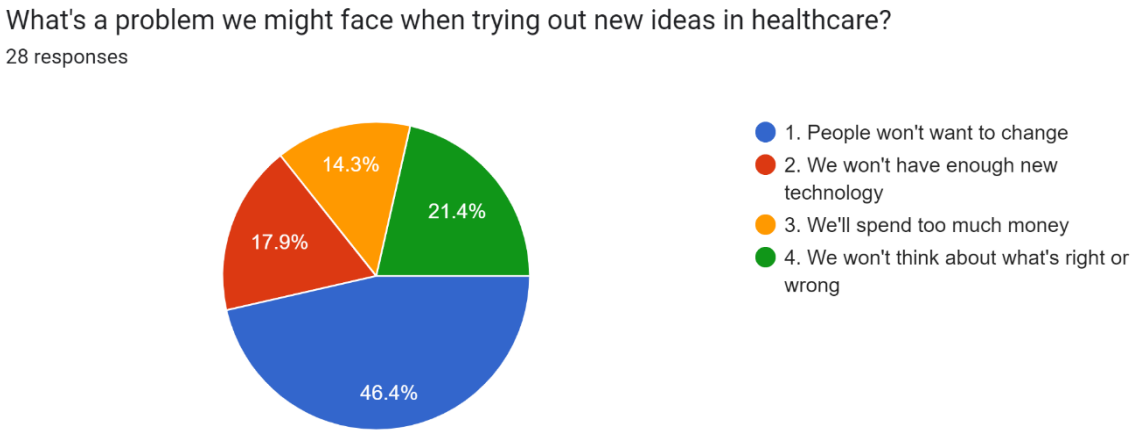
28 responses



How can trying new ideas change healthcare?

28 responses





A survey was conducted in the form of Google Forms where a total of more than 50 people were surveyed belonging from different backgrounds professional, unprofessional, student, and teachers. 53.6% of people were aware of speculative design and what the term means. 60.7% believed that speculative design could benefit society by challenging existing norms and prompting critical thinking whereas 28.6% believed that speculative design could benefit society by creating products that meet immediate consumer demands. A question was put up "What is speculative design in healthcare?" where 78.6% of people came up with the idea of "A creative approach to envisioning potential futures and innovative solutions in healthcare". Early diagnosis of any health problem is very important and 53.6% of people agreed with it that it's extremely important to early diagnosis for any health problem. An interesting question was asked by the people which was "Would you trust the process of AI in the diagnosis?" here we have a different set of answers 46% answered maybe it means they are a little hesitant with the idea and would still think of a professional to do the work whereas 25% choose "NO" as an option and would not trust the process at all and 25% people think it's a good and faster option.

Conclusion

The role of speculative design in healthcare has great significance as speculative design involves envisioning potential future scenarios, technologies, and systems that could transform the way healthcare is delivered, experienced, and understood. It encourages designers, healthcare professionals, and other stakeholders to consider the broader social, cultural, and ethical implications of their work, beyond just the technical aspects. Interdisciplinary collaboration, drawing on insights from fields such as design, sociology, anthropology, psychology, and technology. Through this collaboration, speculative designers explore diverse perspectives and bring together different areas of expertise to imagine and prototype innovative solutions. Overall, speculative design serves as a powerful tool for exploring possibilities, stimulating discussion, and

inspiring innovation in healthcare and beyond. It encourages us to think beyond the constraints of the present and consider alternative futures that may lead to more equitable, sustainable, and human-centered outcomes.

Limitations

- The findings may be limited in their generalizability, as the research relies on a specific sample of participants. The views and experiences of the selected group may not be representative of the broader population.

- Perceptions of inclusivity and awareness of speculative design are subjective and can vary based on individual interpretations. The study may not capture the full spectrum of perspectives on these concepts.

- The research might be influenced by the temporal context in which it is conducted. Trends and attitudes toward speculative design may evolve, impacting the relevance and applicability of the findings.

- Cultural factors can influence participants' understanding and interpretation of speculative design. The research may not fully account for diverse cultural perspectives, limiting the transferability of the results.

- The research may focus on specific speculative design projects, and the findings may not be universally applicable to all forms of speculative design. The diversity of speculative design practices could lead to variations in outcomes

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Dance and Performance Worldwide: Promoting Better Lifestyle, Stable Mindset and Fostering Sustainable Actions

Riddhima Singh, Bhavya Rawat, Kshanika Maheshwari, Aastha Punyani, Lavanya Bathla, Diksha Mohapatra, Ankit Dabbas

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Abstract

Dance has been shown to have positive effects on both physical and mental health in numerous studies. Studies have indicated that consistent engagement in dancing might enhance cardiovascular well-being, augment suppleness and power, alleviate tension and unease, and elevate emotions and self-worth. Dancing is a method of expression that is global, across cultural and linguistic divides. We may encourage better cultural interchange, understanding, and appreciation among varied populations by promoting dance from many civilizations around the world. The coordination of movement and music required for dance can improve the mind-body connection. Studies conducted in disciplines like psychology and neuroscience have demonstrated the benefits of dance for memory, emotional health, and cognitive function.

Dancing encourages social interaction and a sense of community since it frequently calls for group participation and teamwork. Studies have indicated the significance of dance.

Keywords: Dance, Performance Art, Sustainability, Lifestyle Change, Better Lifestyle, Conscious Consumer, Stable Mindset, Positive Thinking, Earth Conscious

Introduction

- Impact of SDG 12 on Dance and Performance Worldwide: Promoting Better Lifestyle, Stable Mindset, and Fostering Sustainable Actions.

- SDG 12's focus on sustainable consumption and production can greatly influence global dance and theatre. Implementing sustainable practices in production, costumes, and supply chains fosters healthy lifestyles and protects the environment.

- Impact of SDG 14 on Dance and Performance Worldwide: Promoting Better Lifestyle, Stable Mindset, and Fostering Sustainable Actions.

- SDG 14, focusing on ocean conservation, can influence dance and performance by promoting sustainable actions. Dance can raise awareness about marine issues; encourage sustainable practices, and foster environmental consciousness. Through performances and partnerships, dancers can inspire action and support initiatives aimed at achieving SDG 14 and preserving marine ecosystems.

- Impact of SDG 15 on Dance and Performance Worldwide: Promoting Better Lifestyle, Stable Mindset, and Fostering sustainable actions

- SDG 15, focusing on terrestrial ecosystem conservation, can impact dance and performance by promoting sustainable actions. Dance can raise awareness about biodiversity, advocate for sustainable land management, and celebrate nature's beauty. Through performances and advocacy, dancers can inspire action and support initiatives for achieving SDG 15 goals.

Literature Review on Dance and Fashion

So, we started to approach this topic of Bhartiya dance and fashion by how the different types of Bhartiya dance forms came to be during the British period and how they were treated. We came to see how fashion also changed throughout time in the dance world both in the east as well as the west. We also learned the different types of dances forms that are practiced in India and how each of their attires differ yet quite similar at the same time, and how many of the Indian traditional attires and culture has bloomed from them.

We also got to know what goes on, within and beyond different types of artists from all the parts of the world and how they believe in the Indian culture and traditions and respect them to the heights of supreme.

One of such artist's documentaries that we came across was that of **"Colleena Shakti."** She was so touched and inspired by the Indian culture, dance, traditions that now she has been living in India for the past 20 years or so and has excelled in studying Odissi and Rajasthani dance and using these art forms to express it on stage around the world through her own unique dance form called Fusion. Colleena dedicates her life and dance to the power of her "lineage" and guru. This inner calling to know and seek truth has not only changed her life, but changes those that have seen her on stage and have studied with her at the, Shakti School of Dance in Pushkar, India.

There are many more artists that have connected to dance at such high spiritual levels that it has completely changed their lives and for those as well who have gotten inspired by them.

Research Gap

The aim of this study is to understand how dance has influenced the mindset of people and in turn changed their equation with fast fashion or fashion in general. In our study and research so far, we are trying to understand:

- The eras where the dance forms have had influence.
- How strong was the influence and in case it was not a wide spread influence, what were the factors responsible?
- Which dance form been more influential in the Indian context? If found, try to analyse it under the jurisdiction of gender, strata of society following it, the reasons for its acceptance and gradual decline if applicable.
- Has fashion influenced the attires of our dance forms?

Objective

- Define key terms and concepts related to dance forms and fashion.
- Explore the historical, emotional connect of dance and performances using discussions and documentaries as a tool to help student understand the cultural and artistic point of view of the practitioners.
- Examine the significance of dance on an individual's persona.
- Analyse the relevant data to prove our hypothesis "Dance and Performance Worldwide: Promoting Better Lifestyle, Stable Mindset and Fostering Sustainable Actions."

Our Hypothesis

The paper explores how engagement in dance and performative arts worldwide can enhance lifestyle, mental health, and promote sustainable behaviours. Drawing from previous research, it aims to validate this notion and offer insights for fostering a healthier society through creative activities like dance, fashion, and sustainability.

Research Methodology

- **Type of Research:** Qualitative (Since the topic is about human perception, we are using the qualitative approach. Qualitative research

involves collecting and analysing written or spoken words and textual data. We will focus on body language or visual elements and help to create a detailed description of our observations. We will be gathering qualitative data through interviews, observation and focus groups using a few carefully chosen participants.

- **Target sample:** Students / Faculty / Staff / Parents
- **Type of Sampling:** Convenience Sampling
- **Sample Size:** 20 people each
- **Tools to be used:** Questionnaire to be filled with MCQs, one on one discussion.

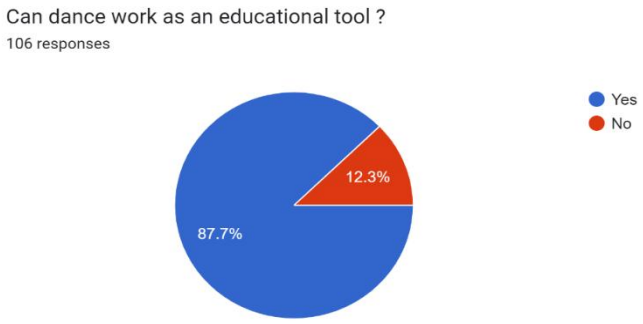
Findings and Research

- **Research on How Dance Promotes Inner Sustainability**

Traditional art forms, like dance and performance, play a crucial role in enhancing individual and community well-being while promoting sustainability. By fostering emotional, physical, and cultural engagement, they contribute to personal and social harmony. This transition to sustainability involves inner sustainability, shaping values, empathy, and collaboration essential for creating a sustainable society.

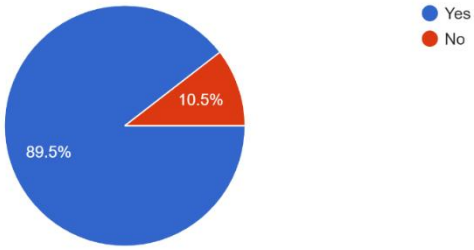
A path to inner transformation via compassion as a series of embodied, action-driven processes may be provided by dancing. Combining multiple of these abilities at once enhances emotional intelligence. So far, we have seen that certain combinations of dancing moves can induce transformational moods. Interventions that alter individuals and social groups have made use of the arts. The way that rhythmic play and movement engage the entire body (as well as the senses) is probably the foundation for the transformational power of the arts. We built a questionnaire of (12) questions and collected data of (120) people spread across different age group, profession and gender. The findings are stated below as graphs:

Google Form Research



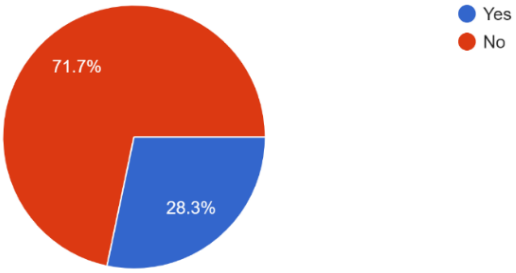
An aesthetic form of body movement that brings spectators to connect closer to modern issues is called a "DANCE ACTIVISM COMMUNITY". Nowadays, d...Do you think this is an effective tool to have?

105 responses



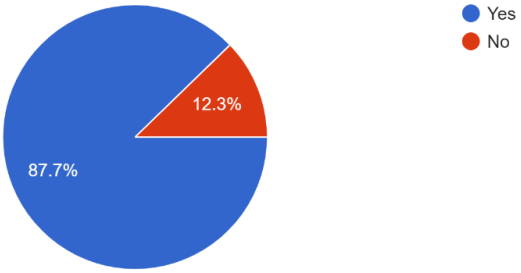
Is there an active " dance activism community" around you ?

106 responses



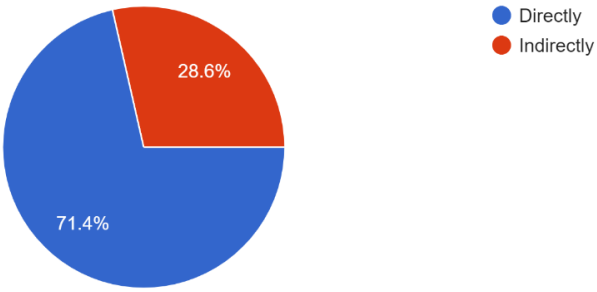
Do you think it can impact if it exists ?

106 responses



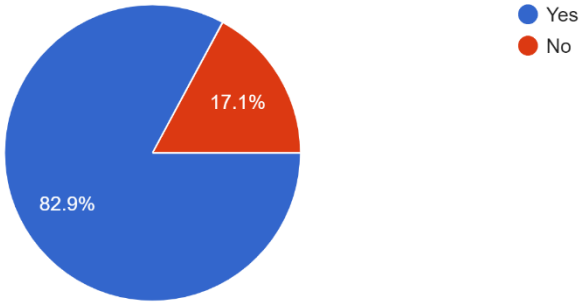
If it exists, would you like to be directly or indirectly a part of that community ?

105 responses



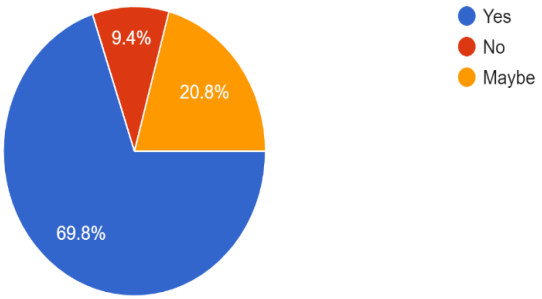
Do you believe performers and dancers are more confident about themselves and rely less on changing with changing trends to stay relevant?

105 responses



Do you think this confidence can impact your need to buy fashion?

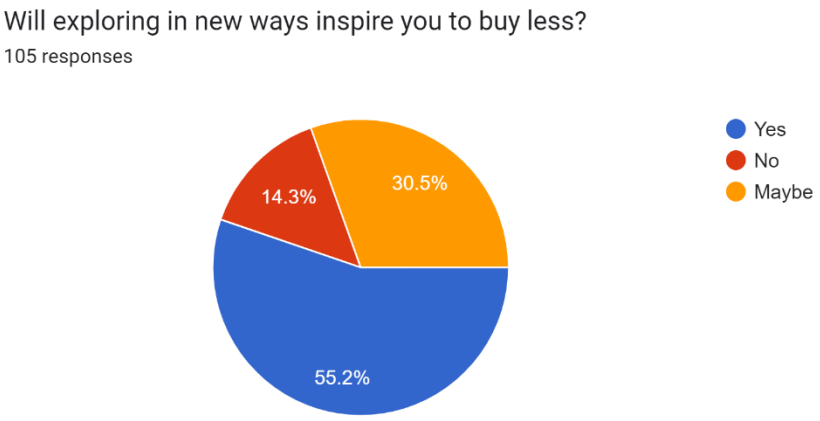
106 responses

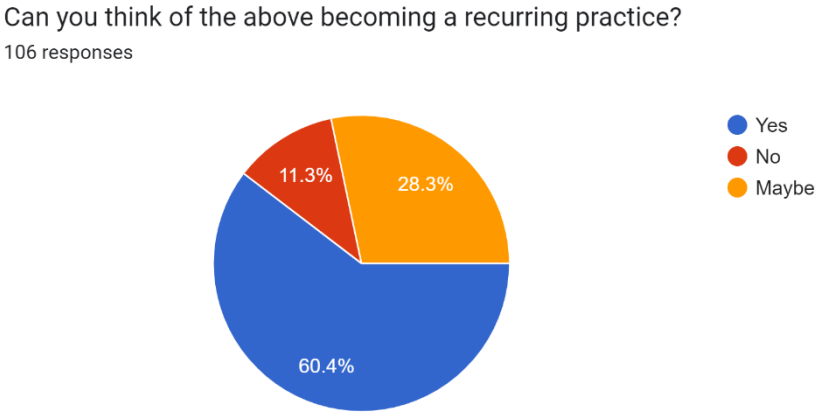


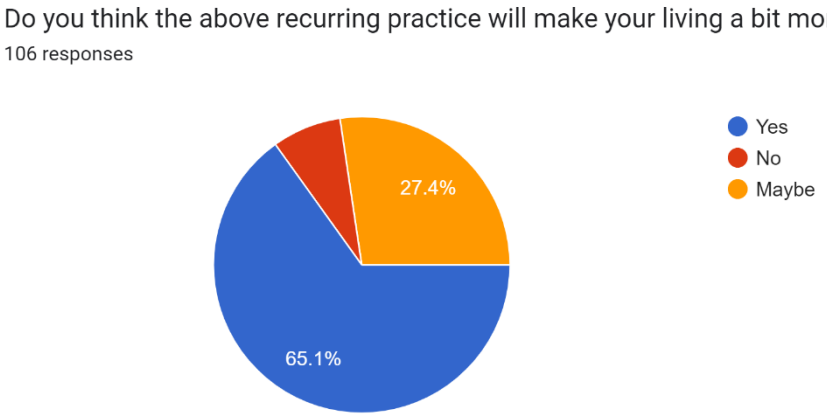
How do you think it will impact?

105 responses









Discussion

Dance can support inner sustainability by providing mechanisms such as

Emotional Benefits of Dance: Dancing offers people a way to communicate and let go of their feelings. Dancers may express their emotions, experiences, and narratives via movement instead of just words. Through catharsis and

emotional release provided by this self-expression process, people are better able to comprehend and control their emotions. Dancers can get better emotional well-being and inner harmony by recognizing and expressing their feelings.

Dancing's Mind-Body Connection: Dancing demands a close relationship between the mind and body. Dancers practice mindfulness by concentrating on their breathing, body language, and feelings in the present. Through the cultivation of heightened body awareness, mindfulness enables people to establish deeper connections with their physical selves. Dancing encourages a sense of inner harmony and self-awareness by developing this mind-body connection.

Boosting Confidence through Dance: Dance can increase one's sense of self-worth and confidence. People feel proud of themselves as they improve their dancing abilities, learn difficult moves, and perform for an audience. Dancers gain self-perception and confidence in their skills through encouraging comments and acknowledgement. Beyond the dance floor, this enhanced confidence boosts general self-esteem and a long-lasting sense of self-worth.

Dance as an Anti-Stress Exercise: Dancing is an effective way to reduce stress and enhance mental health. Dancing is a creative and entertaining hobby that enables people to momentarily detach from the stresses of everyday life. Dance's rhythmic patterns and physical movement encourage the release of endorphins, which lower tension.

Personal Growth through Dance: Dancing provides avenues for personal development and self-exploration. People discover their skills, weaknesses, and places for growth via the struggles and victories they face in dancing. Dancing professionals can better understand their passions, values, and personal objectives through this process of self-discovery, which cultivates self-awareness. In addition to exposing people to various viewpoints, styles, and cultures, dance can help them grow personally by expanding their horizons.

Dancing's Body Positivity and Acceptance: Dancing encourages self-acceptance and body positivity. People of all shapes and sizes can find acceptance and celebrate their individual physicality in the diverse and inclusive world of dance. Dancers learn to love their bodies and see the beauty in each person's uniqueness through movement.

Dance and sustainability- As time passes, people’s needs change and such changes affect our conception of what sort of development is sustainable. This makes the term “sustainable” somewhat fluid and difficult to define.

Dance artists can interact with sustainability through 2 approaches: The operations approach and the artistic approach. According to four organizations — Arts council England, Kidd pivot, Eiko & Koma, and Vertigo Dance Company, dance could be a tool for sustainability advocates to better communicate material to non-scientific audiences. Introducing environmental material through dance or other artistic mediums is a way of reframing conversations so that they appeal to broader audiences and target different types of solutions. A true shift toward a sustainably minded society will come from many sources, including a shift in cultural values about consumption and humankind's relationship to the natural world. Art is a driver and creator of culture. If combined effectively, arts and sustainable development could help to shift our society in a sustainable direction.

Dance proves effective in addressing sustainability due to its widespread appeal, uplifting nature, versatility, and expressive potential. However, challenges include its nonverbal nature and practical limitations. Studies demonstrate the diverse benefits of art, including cognitive enhancement, memory retention, empathy promotion, and enjoyment of learning.

According to Michael Jackson "Being on stage is magic. There is nothing like it. You feel the energy of everybody who is out there. You feel it all over your body. When the lights hit you, it's all over." The feeling of being overwhelmed comes naturally to dancers or to any artist/performer for that matter. They are constantly surrounded by the pressure of other stage performers which might have a negative impact on them. Performing on stage helps build self confidence and gives them a sense of happiness afterwards.

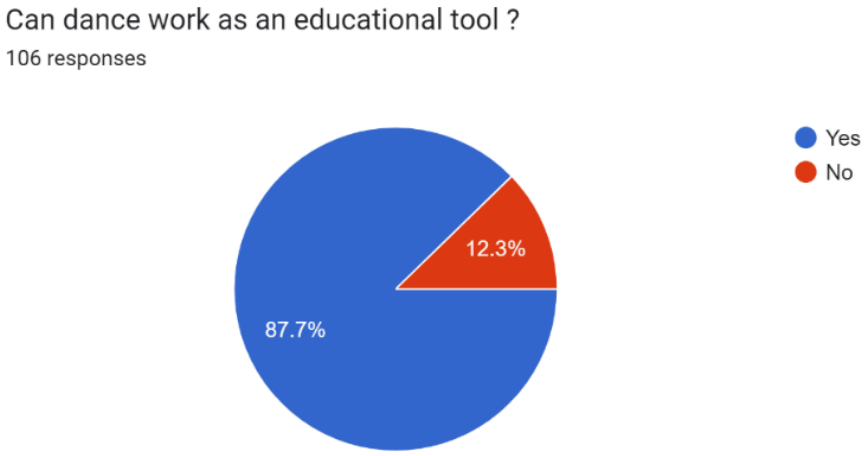
Dancing has been shown to increase self confidence and self-esteem by providing an expressive outlet and the opportunity to learn something new and fun. A worldwide marketing initiative by PepsiCo was launched in 2010 and was built around an online "Dance Off" contest. The tournament's goal was to promote physical exercise among individuals of all ages, concentrating on kids and teens. The "Dance Off" competition at the heart of PepsiCo's campaign enticed participants to post videos of themselves dancing to hit tunes. Coca-Cola, which had started a comparable campaign at the same time as Pepsi Co, presented fierce competition. Nevertheless, PepsiCo has a proven track record of promoting health and well-being via its products and advertising endeavours. The business also had a solid consumer base that valued its efforts to encourage healthy living.

Based on the learning and discussions above from our preliminary research, we understand that dance, including performing arts leaves a mark on us as a personality and pushes us towards stable, secure mindset.

Conclusion Review

The below pie chart was the first question of our google form survey that we had conducted where we had asked whether people believed that dace can also work as an educational tool and almost 87-88% people believe that it can be an educational tool as many studies previously have stated that humans retain and relate more to visual teachings than textual method of teaching as our brain tends to remember visuals more easily than text. Dance technically will be acting as a stimulating educational tool because people get to explore the topics in their own unique perspectives.

Using dance could be a very good tool to teach something new to big or large number of crowds with better results than the usual methods or tools.



Yes, dance can be an educational tool that can help students develop in many ways, including socially, emotionally, and academically. Research suggests that movement can help students understand the world and function in it, and that through dance, students can:

- Learn how to apply new skills and concepts through movement Interpret choreography and respond to it
- Solve movement problems
- Create choreography in response to a prompt
- Dance can also help students improve their memory and concentration, which can benefit them in various subjects.
- It can also be an engaging way to learn about rhythm, patterns, and coordination.

These questions suggested creating a community that can be effective in the above-given statements derived from this research. Most of the responses were positive.

Now to achieve this there was a space where someone can perform such experiments where they are encouraged for going beyond the norms and create something not just for entertainment but educational purpose as well. This idea gave birth to a "Dance Activism Community".

The dance activism community presents a powerful avenue for promoting sustainability through dance, fostering connections and inspiring change in daily life. Surveys and observations support the potential of these communities to advocate for sustainability through various dance forms. Dance enhances self-awareness, confidence, and expression, influencing daily behaviours like fashion choices, which can contribute to personal empowerment and sustainability.

Generally, dancers are more confident about themselves and especially about their art and generally do not prefer to change with trends but I personally believe that they are more prone and adjusting to change than a normal or any other person because they are used to changing and mixing up styles and experimenting to create something new and exciting each time they present or perform. Now this confidence can sometimes also be contagious in a good manner.

Since this confidence can impact our need to buy fashion because if they can mismatch, upcycle and thrift then why can't we? Right, we regular people should also normalize repeating and reusing clothes in such a manner that we reduce our consumption rate of fast fashion.

Once people are aware and educated enough as to how dancers also reuse their props and mismatch their garments and re-use them, they might also change their perspective about just wearing a particular clothing in a particular style or with another clothing piece. This might lead to people buying less and less new pieces and styling different pieces from their existing wardrobe and get their creative minds rolling.

After analysing the responses of the people, they might and should be inspired to buy less because as the saying goes "less is always more" that might just become true for many if they try to make it work. According to me in all honesty the chances of this happing is much more than the stats we have right now because of our culture as well. The Indian culture works on thrifting of

clothes and hand me downs so this is technically not a very new or absurd idea to us and could just work out in our Favour.

Yes, these concepts of thrifting, hand me downs, borrowing and mis matching have been existing in India for years and decades so this is a recuring practice in India should not be that much of an issue.

Well, there are chances of this practice changing the way of our living it can make it a little bit more sustainable or at least more nature conscious than before because when we consciously shop, we reduce the fabric waste then there is chance that dude to reduction in the consumption or demand the supply of these will go down meaning it saves a lot more than just water, land, soil.

Therefor just following this one practice meticulously might just change the quality of living for the people as well as save the planet by some percentage of our contribution.

Limitations

- **Lack of Common knowledge:** a lot of people do not know of such communities and hence their answers might not be based on actual experience. It might delve more on aspirational outcomes.

- **Lack of motivation:** this effect can be vouched for provided society if engaged in the action. In the scenario where despite availability, people are not becoming a part of the dance activism, the said change cannot be projected.

- **Sampling Bias:** The survey was only distributed online, it may have excluded individuals without internet access, leading to a bias towards technology friendly individuals. Additionally, the circulation was among people and community members around our educational and private circle, hence it does not profess diverse demographic analysis.

- **Self-selection Bias:** If the survey was shared on design-relates forums or social media groups, it may have attracted respondents with a specific interest in design, potentially skewing the findings towards their perspectives.

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Unleashing Your Inner Artist: Transforming Basic Drawing Skills with Image Thinking Techniques

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GD Goenka University

Abstract

In response to Gurugram's lag in drawing, designs and image thinking skills, particularly evident in the dominance of other state artists and the dearth of indigenous talent, this research endeavours to introduce drawing skills and image thinking techniques into the curriculum of children aged 9 to 12 years. Despite the recognized importance of creativity and designs in societal progress, a notable gap exists in the integration of these skills into early education in Gurugram. Consequently, this study aims to address this deficiency through a systematic exploration of the potential benefits of early exposure to drawing and image thinking on the observation development of children.

The absence of existing research validating the efficacy of such interventions underscores the novelty and urgency of this endeavour. By employing a structured approach, this research seeks to establish a causal link between early engagement with drawing skills and image thinking techniques and the subsequent enhancement of creativity and designs development in Gurugram. Central to this investigation is the recognition of drawing as a fundamental skill that nurtures imagination, problem-solving abilities, and image thinking from a young age.

Through a rigorous examination of the educational landscape and societal attitudes towards designs in Gurugram, this study aims to provide empirical evidence supporting the integration of drawing and image thinking into the curriculum as a means of fostering holistic development in children. By elucidating the potential impact of this intervention on individual growth and state progress, this research endeavours to catalyse a paradigm shift in educational priorities and cultural values, thereby contributing to Gurugram’s journey towards becoming a hub of creativity and design Whatever that we have studied in this topic where we have taught children various techniques hand eye coordination , stick figure ,shadow drawing , observation skills with in 8hrs of teaching, what if we have taught for longer time that would be great affects and fruitful results and still that we have studied and taught there are still many improvements have been seen.

Introduction

India's rich cultural heritage is renowned worldwide, we notice yet recent years have witnessed a concerning trend a decline in designs and observation development. According to us decline is reflected not only in the dominance of foreign artists on national platforms but also in the absence of indigenous talent flourishing in various artistic spheres. Concurrently, there exists a noticeable lack of emphasis on drawing skills and design thinking in the early education curriculum across the country.

Recognizing the urgency of addressing this issue, this research endeavours to introduce drawing skills and image thinking techniques into the curriculum of children aged 9 to 12 years. By focusing on this critical developmental stage, we aim to harness the innate creativity and curiosity of children to instil a lifelong appreciation for designs and image thinking. Moreover, by integrating drawing into the educational framework, we seek to bridge the gap between theoretical knowledge and practical application, thereby fostering a holistic approach to learning.

Literature Review

Designs education has long been recognized as a crucial component of holistic development, fostering not only drawing and image thinking but also cognitive, image manipulation.

Scholars such as Eisner (2002) advocate for the inclusion of designs-based learning experiences in education, arguing that such experiences cultivate critical thinking, problem-solving. Moreover, research by Winner and Hetland (2000) underscores the positive impact of designs education on academic achievement, highlighting correlations between designs participation and enhanced performance in mathematics, reading, and standardized tests.

Drawing, in particular, has been identified as a fundamental skill that facilitates cognitive development and creative expression in children. Piaget (1962) emphasized the role of drawing as a means for children to construct and communicate their understanding of the world, suggesting that drawing serves as a precursor to symbolic thought and language development. Similarly, Arnheim (1974) posited that drawing engages perceptual and conceptual processes, fostering the integration of sensory experiences and cognitive representations.

Furthermore, research in neuroscience provides empirical evidence supporting the cognitive benefits of drawing. Neuroscientist Dr. Rhonda A.

Atkinson (2017) highlights the neural mechanisms underlying drawing, noting its capacity to enhance spatial reasoning, attentional focus, and memory consolidation. Moreover, studies utilizing neuroimaging techniques have demonstrated structural and functional changes in the brain following drawing practice, indicating its potential for neuroplasticity and cognitive enhancement (Schlegel et al., 2015; Ungerleider et al., 2016)

Despite the wealth of evidence supporting the cognitive and academic benefits of drawing education and drawing, the integration of these practices into mainstream education remains limited, particularly in the Indian context. Historically, Indian education has prioritized rote memorization and standardized testing over creative exploration and critical thinking (Sarangapani, 2003). Moreover, societal attitudes towards art and creativity often prioritize traditional career paths over creative pursuits, leading to a devaluation of artistic skills in educational and professional settings (Gupta, 2018).

In light of these observations, there is a pressing need to advocate for the inclusion of drawing skills and image thinking techniques in the Indian education system. By drawing upon the theoretical frameworks and empirical evidence outlined in the literature, this research seeks to elucidate the potential impact of such interventions on individual development and societal progress. Through collaboration with educators, policymakers, and stakeholders, we aim to catalyse a paradigm shift in educational priorities and cultural values, fostering a future where creativity and artistic expression are valued as integral components of a well-rounded education.

Building upon the existing literature, this research endeavours to fill the gap in knowledge by focusing specifically on the integration of drawing skills and image thinking techniques into the curriculum of children aged 9 to 12 years in India. While prior studies have examined the cognitive benefits of art education and drawing practice, few have explored the potential of early intervention to nurture creativity and aesthetic appreciation during this critical developmental stage. By targeting children in late childhood, a period characterized by increased cognitive flexibility and social awareness, this research aims to leverage their innate curiosity and receptivity to new experiences.

However, despite the cultural richness of India, there exists a disconnect between traditional drawing practices and modern educational paradigms. The colonial legacy of the Indian education system, with its emphasis on Eurocentric ideals of rationality and productivity, has marginalized indigenous forms of knowledge and artistic expression (Chakrabarti, 2007). Consequently, there is a

need to reconceptualize art education in India to encompass both traditional and contemporary modes of expression, thereby fostering a sense of cultural identity and pride among students.

In addition to addressing the cultural dimensions of drawing education, this research aims to explore the broader societal implications of nurturing creativity and image thinking skills in children. By engaging with stakeholders across various sectors, including education, government, and industry, we seek to advocate for the recognition of drawing and image thinking as essential skills for the 21st century. In an increasingly globalized and technologically-driven world, creativity and innovation are recognized as key drivers of economic growth and social progress (Florida, 2002). By equipping children with the tools to image thinking and image manipulation, we aim to empower them to navigate the complexities of the modern world and contribute meaningfully to society.

The novelty of this research lies in its systematic exploration of the potential benefits of early exposure to drawing skills and image thinking techniques on the observational development of children. By conducting a comprehensive review of existing literature and empirical studies, we aim to provide empirical evidence supporting the efficacy of this intervention. Furthermore, through collaboration with educators, policymakers, and stakeholders in the field of education, we seek to advocate for the integration of drawing and artistic expression into the mainstream curriculum.

In summary, the literature review presented here provides a foundation for understanding the importance of integrating drawing skills and image thinking techniques into the curriculum of children aged 9 to 12 years in India. Drawing upon theoretical frameworks from education, psychology, neuroscience, and cultural studies, this research seeks to elucidate the potential benefits of such interventions for individual development and societal progress. By bridging the gap between theory and practice, we aim to advocate for a more holistic and inclusive approach to education that values creativity, diversity, and cultural heritage.

Research Gap

Despite the recognition of the importance of integrating drawing skills and image thinking techniques into the curriculum of children aged 9 to 12 years in India, several research gaps remain to be addressed.

Firstly, while there is ample theoretical and empirical evidence supporting the cognitive and academic benefits of art education and drawing

practice, there is a lack of research specifically focusing on the efficacy of early intervention programs targeting this age group in the Indian context. Existing studies primarily examine the general benefits of art education or focus on specific populations or age groups, leaving a gap in knowledge regarding the unique developmental needs and socio-cultural factors influencing art education in India.

Secondly, while the potential benefits of drawing skills and image thinking techniques are well-documented, there is limited research addressing the challenges and limitations associated with implementing these interventions in real-world educational settings. Factors such as resource constraints, teacher training, curriculum integration, and assessment methods present significant challenges that need to be addressed to ensure the effective implementation and sustainability of art education programs.

Thirdly, there is a need for research exploring the socio-cultural dimensions of art education in India, particularly regarding the intersection of traditional artistic practices, modern educational paradigms, and societal attitudes towards creativity and artistic expression. Understanding how cultural heritage, colonial legacies, and global influences shape perceptions of art and education is essential for designing culturally relevant and inclusive art education initiatives.

Finally, there is a need for research addressing the ethical considerations and potential pitfalls associated with assessing children's artistic abilities and creativity. Issues such as cheating, plagiarism, and cultural biases may influence assessment outcomes and affect the validity and reliability of research findings. Developing ethical guidelines and methodological approaches for assessing children's artistic skills and creative potential is essential for ensuring the integrity and validity of art education research

Objectives

- To foster a culture of creativity and artistic expression among children aged 9 to 12 years in India by introducing drawing skills and image thinking techniques into the mainstream education curriculum.

- To cultivate a mindset of originality and innovation by encouraging children to develop their unique artistic voice and creative problem-solving abilities, thereby reducing reliance on imitation and plagiarism.

- To provide children with the tools and confidence to generate and express their own ideas through drawing, enabling them to contribute meaningfully to India's cultural heritage and artistic landscape.

- To enhance children's cognitive abilities, including visual-spatial reasoning, critical thinking, and imagination, through structured drawing activities and exercises designed to stimulate creative thinking.

- To assess the effectiveness of art education interventions in promoting creativity and aesthetic appreciation among children, using both qualitative and quantitative methods to measure changes in artistic skills, attitudes towards art, and academic performance over time.

- To identify and address barriers to the successful implementation of art education programs in Indian schools, including resource constraints, teacher training needs, curriculum integration challenges, and cultural biases.

- To advocate for the recognition of drawing skills and image thinking techniques as essential components of a well-rounded education in India, engaging with policymakers, educators, parents, and other stakeholders to promote the value of creativity and artistic expression in society.

- To contribute to the broader discourse on art education and creativity by disseminating research findings through academic publications, conferences, workshops, and public outreach activities, thereby raising awareness and fostering dialogue on the importance of nurturing creativity in children for societal development.

Hypothesis

Students who participate in an 8-hour program focused on image thinking techniques will demonstrate a significant improvement in their basic drawing skills compared to a control group or their own pre-program performance.
This hypothesis is based on the assumption that image thinking techniques like stick drawing, hand-eye coordination exercises, mind mapping, and shadow drawing will:

- Enhance students' ability to visualize and translate mental imagery into drawings.
- Improve their understanding of fundamental drawing principles like proportions, perspective, and shading.

- Foster hand-eye coordination and motor skills necessary for drawing control.

Methodology

This section outlines our systematic approach to evaluate the effectiveness of image thinking techniques in enhancing children's basic drawing skills. By detailing participant selection, intervention procedures, assessment methods, and ethical considerations, we aim to provide valuable insights into the impact of image thinking strategies on children's artistic development.

Step	Description
Selectio of Schools	Three schools will be selected, ensuring diversity in location, socioeconomic status, and approach.
Participant Recruitment	A questionnaire will be administered to 100 children, with 25 randomly selected from each school.
Intervention Design	An 8-hour program focusing on image thinking techniques will be conducted, led by trained facilitators.
Pre- and Post-Test Assessments	Drawing assessments will be conducted before and after the intervention to evaluate basic drawing skills.
Data Collection	Quantitative data will be collected from assessments, including scores and demographic information.
Data Analysis	Statistical analysis will be conducted to compare pre- and post-test scores and assess effectiveness.
Limitations	Potential limitations, such as sample size constraints, will be acknowledged in the study.

This study highlights the potential of image thinking techniques to enhance children's drawing skills, advocating for their integration into art education for fostering creativity.

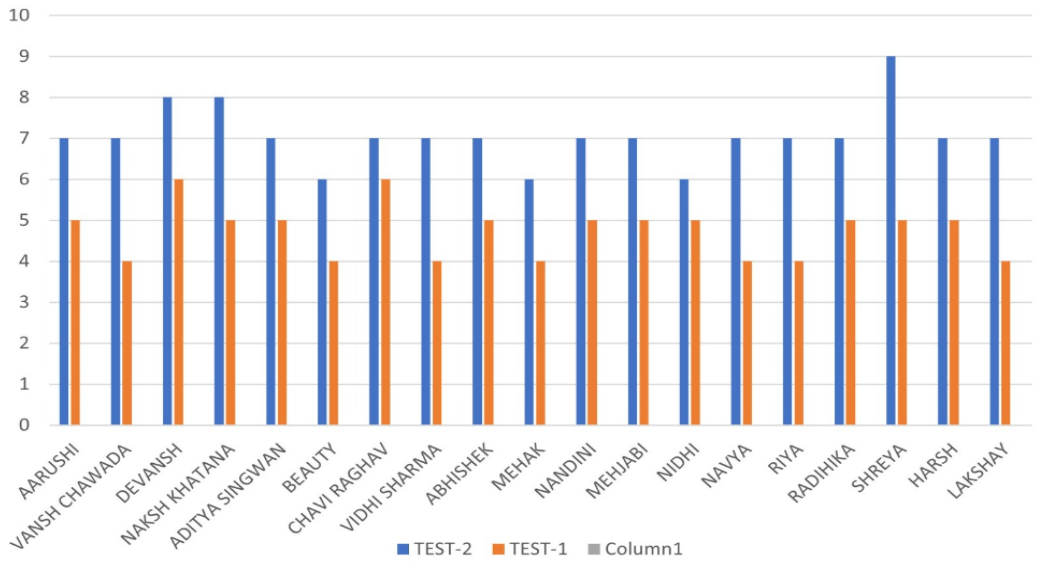
Findings

This is our primary research. We randomly selected a school out of three schools the school name is Hari om international school, Sohna (Gurugram). We took test of 100 students (test 1), selected 25 random students and taught them basic drawing skills for about 8 hours. We aren’t professional drawing teacher but we have been learning since semester 1, whatever we have to teach and we took another test (test 2). We observed a great difference after comparing before and after test. They performed very well in the test 2. In

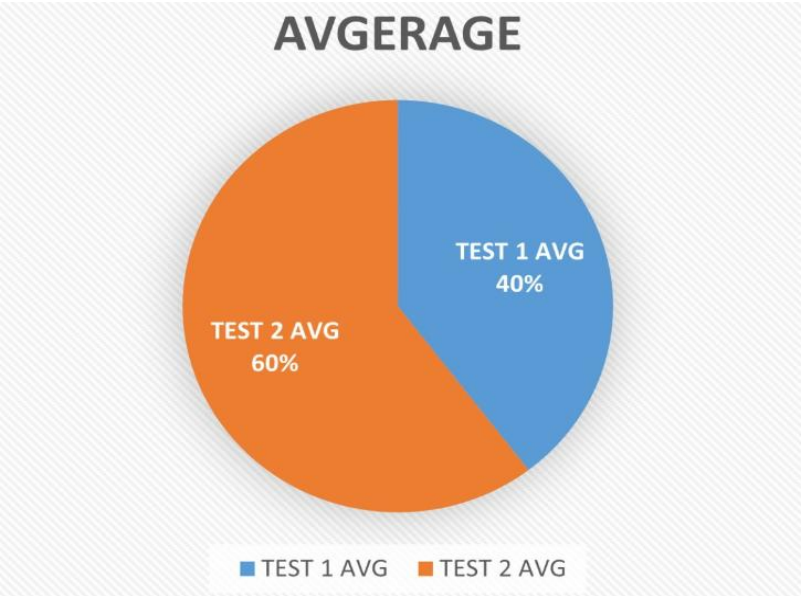
school we talked to the principle and drawing teach and ask that how much time they give to drawing subject they said we give 40 minutes of class (1 class in a week) and they give 3 class in a week to other subjects.

We teach them the following things: Stick figure drawings, Hand eye coordination, Shadow drawing, Image thinking techniques, Modification, Mind mapping, Observation skills.

Students marks report: This is the 10 marks of number test. This is sample of 20 students.test-1 is before test and test -2 is after test, this test is checked by drawing teachers of GD goenka university.



Change in before test and after test:



This is the question paper or this research
Do any three:

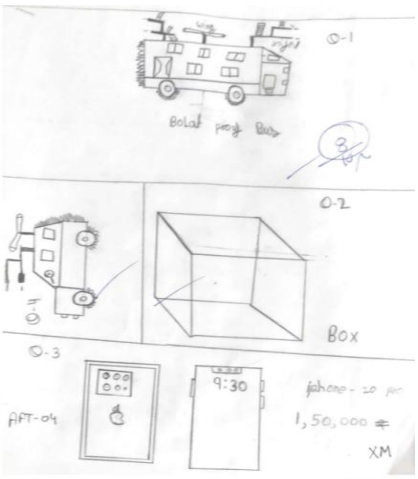
- **Draw your favour vechicle which you like**
- **Draw anything with lines**
- **Draw your favorite thing in class**
- **Combine all questions and make a unique drawing**
- **Draw a 3D cube**

Pictures of Teaching Students:-

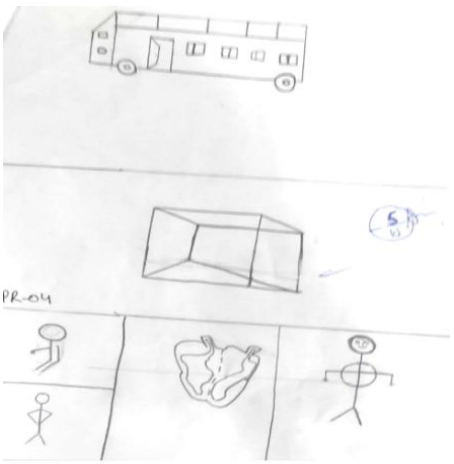


***There* are some samples of tests:**

Student 1

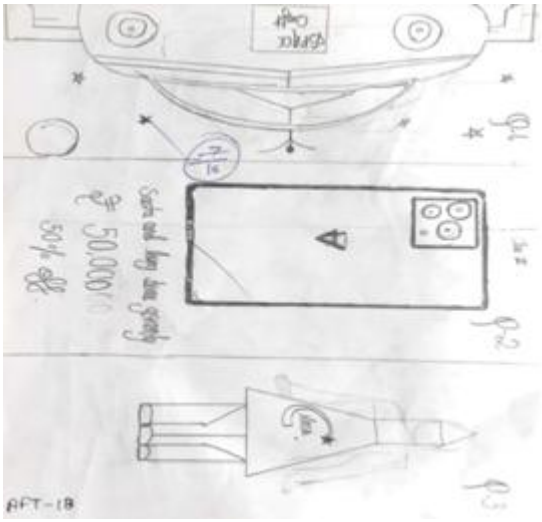


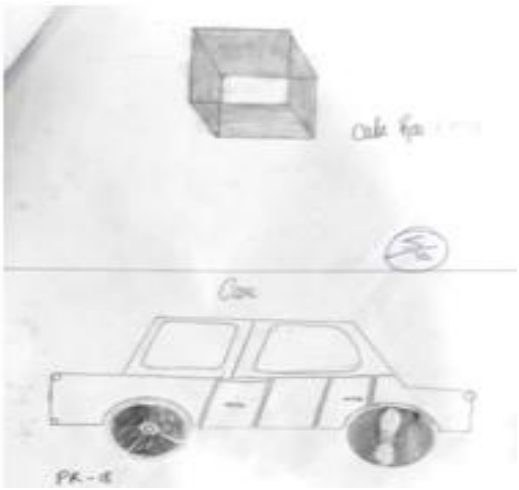
After test (Test-2)



Before Test (Test-1)

Student -2



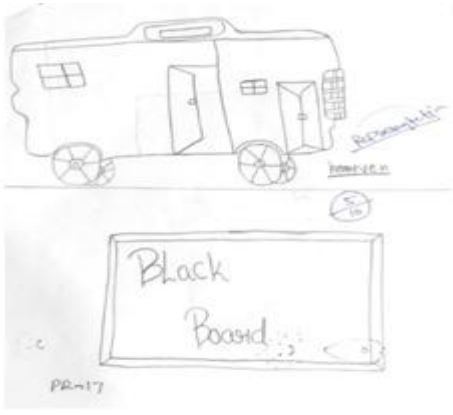


After test **Before Test**

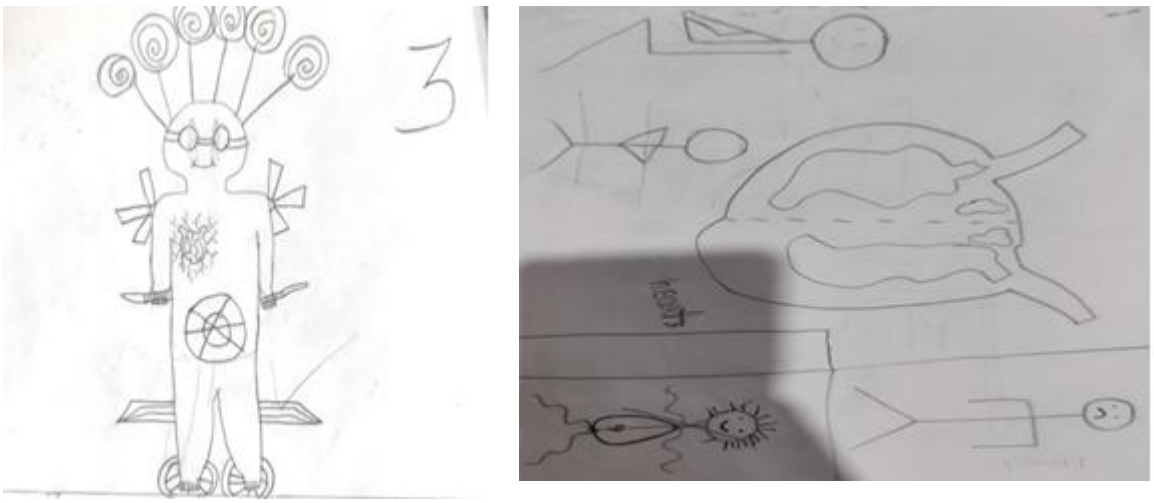


Student – 3





Before Test



After Test

Recommendation

We aren't professional teachers still we learn basic drawing skills and able to teach them and manipulate students towards think about creative and innovative ideas. If we can do this then if Indian schools can give equal imports to drawing as compare to other subjects, then we can bring a big change in students.

Observations and Results

Following the implementation of image thinking techniques, a significant increase in students' creativity was observed. Specifically, students exhibited a greater willingness to explore unconventional ideas and approaches in their drawings. This newfound creativity was particularly evident in their ability to modify and embellish drawings, reflecting a 25% increase in the application of imaginative modifications. Moreover, students demonstrated a notable improvement in their ability to draw specific objects, such as cars, with an approximate 30% enhancement in accuracy and detail. These results indicate that image thinking techniques and image manipulation effectively foster students' creative thinking skills, enabling them to produce drawing that reflects their unique perspectives and imaginative insights.

The observed improvements in students' drawing abilities suggest that the image thinking techniques had a tangible impact on their observation development. By engaging with activities such as image thinking and visual problem-solving, students honed their skills in depicting details and proportions, resulting in more refined and expressive drawing. Additionally, the collaborative and exploratory nature of the intervention program encouraged

students to experiment with different design elements and techniques, further enhancing their creative output. Overall, these findings highlight the effectiveness of image thinking techniques in enhancing students' drawing skills and fostering a more dynamic and expressive approach to art.

Moreover, the data collected throughout the study corroborates the qualitative observations of increased creativity and improved drawing abilities among students. By quantifying the percentage increase in the application of imaginative modifications and the accuracy of drawing specific objects, such as cars, the study provides empirical evidence of the effectiveness of image thinking techniques. These findings have significant implications for art education, suggesting that incorporating image thinking techniques into the curriculum can effectively enhance students' creative thinking skills and artistic development.

Conclusion

In conclusion, the implementation of image thinking techniques has yielded significant improvements in students' creativity and drawing abilities. Through engaging with activities designed to stimulate imaginative thinking and problem-solving, students demonstrated a notable increase in their willingness to explore unconventional ideas and modify their artwork.

Moreover, the observed enhancements in their ability to draw specific objects, such as cars, highlight the tangible impact of image thinking techniques on students' artistic development. The quantitative data further supports these qualitative observations, providing empirical evidence of the effectiveness of image thinking techniques in fostering creativity and enhancing drawing skills among students.

These findings underscore the importance of incorporating image thinking techniques into art education curricula. By providing students with opportunities to engage in creative exploration and experimentation, educators can empower them to develop their unique artistic voices and express themselves more confidently through art.

Moreover, the collaborative and exploratory nature of image thinking techniques fosters a supportive learning environment where students feel encouraged to take risks and embrace their creativity. Overall, the results of this study suggest that image thinking techniques have the potential to revolutionize art education, equipping students with the skills and mindset necessary to thrive in an increasingly complex and dynamic world.

Limitations

- **Small Sample Size:** The study's sample size was relatively small, potentially limiting the generalizability of findings.
- **Short Intervention Period:** The 8-hour intervention duration may not capture long-term effects of image thinking techniques.
- **Selection Bias:** The inclusion of only voluntary participants could introduce bias, affecting the validity of results.
- **Absence of Control Group:** The lack of a control group receiving no intervention limits the ability to isolate the effects of image thinking techniques.
- **Subjective Assessment:** Assessment relied on subjective measures, potentially introducing bias in the evaluation of outcomes.
- **Limited Generalizability:** Findings may not be applicable to diverse cultural or educational contexts.
- **Ethical Considerations:** While ethical guidelines were followed, potential ethical challenges remain, requiring ongoing attention.

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